THE TELEGRAPHIC JOURNAL AND

ELECTRICAL REVIEW.

VOL. XXV. JULY 5, 1889. No. 606.

CONTENTS:

	PAGE
The Compound-Winding Case	1
The Inversions of Polarity in Series Dynamos	4
Precautions for Safety in the Use of Sir W. Thomson's Electrostatic Voltmeters	4
The Present Position of the Electric Light in Paris	5
Study of the Duration of Lightning	6
Ganz's Standard Screw Threads	6
Continental Notes	7
Lightning Conductors (*continued*)	8
A Synthetic Study of Dynamo Machines (*cont.*)—(*illus.*)	10
Notes	11
Electric Lighting at Portsmouth	18
The Electric Lighting Proposals at Leeds	18
City Notes, &c.:—The Amalgamation of Telephone Companies	18
Crompton and Company	19
West African Telegraph Company	19
South of England Telephone Company	20
Traffic Receipts	20
Legal:—United Telephone Company *v.* Ahern and Co.	20
Electricity in Agriculture	20
Report on the First Six Months' Working of the Electric and Allied Trades Section of the London Chamber of Commerce	21
Precipitation of Sewage by Electricity	22
The Electric Light for Manchester	22
Electric Lighting in Bradford	23
Electric Lighting in Lambeth	23
Electric Lighting at Southsea	24
The Compound-Winding Patents	25
Proceedings of Societies:—Physical Society	26
New Patents	27
Abstracts of Published Specifications	27
Correspondence:—A Severe Test	28
Spinning Crystal	28

THE COMPOUND-WINDING CASE.

WE mentioned last week that Lord Trayner had delivered judgment in this case against the holders of Haddan's or Brush's patent, but we had not time to discuss the case with anything like the fullness the importance of the decision demands.

We give the text of the judgment in our other columns.

This lawsuit has quite a little history. Compound-winding was brought out in 1882 as a means of securing constant potential. In 1885, or about then, the Anglo-American Brush Corporation attempted to secure royalties on all compound dynamos, under Brush's patent, as Brush had described and claimed the use of series shunt winding, though he said nothing about its being useful for constant potential.

Many of the large firms preferred paying for licences to the chances of war, but Messrs. Crompton & Co., Goolden & Co., Allen & Co., and the Gülcher Company chose to contest the patent, and Messrs. Crompton entered a cross action on a patent of theirs. The chance of success in an English court of law was very uncertain, whereas the risk of incurring expense was quite the reverse; the interest in purely compound dynamos of some of the firms was small, and one happened to be liquidating or reconstructing just then, so a compromise was made, and the Brush Company became masters of the field.

Messrs. King, Brown & Co., however, were doing a very large business in a quiet way in compound dynamos, and on careful examination of the specification, they decided it was much cheaper to fight than to pay royalties. They therefore took a bold course and brought an action against the Brush Company for threats, under the new Patent Act, claiming that their business was damaged by advertisements on the strength of an invalid patent. This involved an action to determine the validity of the patent.

The plaintiffs' contention was that the patent was void on several grounds:—

1. That series shunt winding had already been published in Varley's specification.

2. That series shunt winding had already been used publicly by Varley in his machine.

3. That the detachable wearing commutator segments were old, having been used by Wilde and by Varley.

4. That a number of commutator detail claims went beyond the provisional specification.

The last is a mere legal point in this case. An inventor may not go beyond his provisional in his complete, as if allowed to do so he might fraudulently insert inventions not thought of at the time of his provisional. Of course there was no suspicion of fraud in Mr. Brush's case; in fact, his American specification containing all these details was filed before the English provisional. The fault rested in another quarter.

Mr. Imray was called first and gave a great deal of educational evidence. Witnesses who had used Wilde commutators then gave evidence, and were followed by Dr. Hopkinson. He pointed out that there were no incandescent lamps in use in 1878, because Edison had not told the world how to make filaments. He also dealt fully with all the doctrinal and technical points of the case. His testimony as to the storage of magnetism and the separation of the development of the electrical and magnetic forces is interesting reading, but is too long to quote.

Mr. Varley's evidence was, of course, exceedingly important. He said his specification described, and was meant to describe, series-shunt; and that his actual machine was also series-shunt. He produced his note book of that time with a diagram of series-shunt winding. His reason for not claiming it was that he thought his brother had described it. Mr. Varley's evidence is exceedingly clear and to the point throughout, and is not at all that of a man who would draw a nonsensical specification.

Messrs. Gorman, Myers, and Garnish spoke as to Varley's machine working; and three real live skilled workmen who had made models were produced.

Mr. Swinburne then followed and gave more argu-

mentative testimony, saying, among other things, that so far from his finding constant potential in Brush's specification, it had taken the Brush people five years to find it there, and he had not found it there yet. He had first told Brush of it.

Prof. Ewing offered didactic evidence; and gave more information about the storage of magnetism. He has, as is well-known, devoted great attention to magnetism, especially to the storage of magnetism. He stated in answer to a question of Lord Trayner, as to whether there was any manifest absurdity in the first three lines of page 7 of Varley's specification "On the contrary, they show that Varley's knowledge of the subject was very much in advance of his time."

The plaintiffs' case was concluded by the appearance of Mr. Brown himself, with an account of an exceedingly complicated accident that had spread like an epidemic over a system of batteries, dynamos and hydraulic rams, with which he had been performing some abstruse feat. The defendants did not cross-examine him as to this. Mr. King, who had looked after the technical part of the case did not appear.

The defendants opened their case with Prof. S. P. Thompson, with his first name spelled wrong. His evidence was tuitional and ratiocinative. He hung the walls round with coloured charts and maps, and went to work with a long pointer. He understood and explained everything but Varley's specification; of that he could make nothing. We think that if he went carefully through Varley's specification with an unbiassed mind he would find no difficulty in understanding all the connections and the working of the machine. Prof. Perry followed, supporting Prof. Thompson, and gave cautious but dogmatic evidence. We do not agree with him that a machine with wrought iron magnets sparks when unexcited.

Sir William Thomson then gave profuse and unbiassed evidence.

Mr. W. H. Preece then followed with much useful information, leading us to suppose compound-winding was invented by the Navy. He never gave any scientifically accurate definition of magnetic potential. His Lordship suddenly asked him whether he belonged to the post office in the next street, or came from somewhere else. He thought Varley's machine such a poor thing at the time it was invented, that it should have been chucked on the dust heap.

Mr. R. P. Sellon gave commercial evidence for his company, and the case was adjourned till Brush's own version could be obtained.

As to the first contention, the Judge held Brush's patent to be void. The whole of the question as to the clearness of the rest of Varley's specification is left untouched in the judgment, and naturally so, for it has little to do with the case; if the specification had been all nonsense except a clear description of series shunt winding, that would have invalidated Brush.

Similarly in the case of Varley's machine, it did not matter in the least how it might be connected up according to the ingenuity of perverse witnesses; the simple question was—How was it actually worked? and the answer was—Series shunt.

We are a little surprised at the decision as regards the detachable segments. We certainly think that the learned Judge confused Varley's commutator with Wilde's. In Wilde's the insulation did not form the body of the commutator, in Varley's and Brush's it did.

On reading over the evidence we cannot refrain from commenting on the strained views taken in many cases by the witnesses. This was commented on to some extent by the Judge. For instance, in the Brush *v.* Crompton case the Brush affidavits were practically unanimous in saying Varley described a double shunt machine. Brush, who probably had not time to wade through a sheaf of affidavits with a microscope—if mixed metaphors are allowed — made out Varley to mean separate armature excitation; and the other witnesses promptly find the same thing for the sake of uniformity.

Mr. Murray's cross-examination always had a saddening effect, and generally wrung an unwilling admission of what he wanted. He showed the keen interest of the sportsman. In one case the Judge said, "You've been playing this fish long enough, I think you'd better land him," which he promptly did.

We are glad, for the sake of the industry, that this patent is broken. Patents, one way or another, have been the greatest bar to progress in electric lighting, as in most new industries. One great defect of our system is that somehow or other the valuable inventions are covered by people who have not invented them. Generally something is described for some chance purpose, and covers subsequent developments as in this case. Jablochkoff's is similar. He saw that if he put his lamps in series on a circuit, and one went out, the others would go out, too; but he thought he would prevent this by putting them on transformer secondaries, so that the dynamo circuit would remain intact, and the lamps would be independent. He is then accidentally enabled to collect royalties on modern transformer distribution. Edison's lamp patent is a notorious example of a "fishing" patent.

As we mentioned in our last, we hope Mr. Varley will get something substantial from the trade. A very few months of the royalties now saved might help him a good deal. The trade is also very deeply indebted to Messrs. King, Brown & Co. for fighting this case, for the validity of a doubtful patent is so much more important to the assignees than to any one alleged infringer that a large company has a very unfair advantage; but if a combination of all the alleged infringers defended, such patents would be properly fought out, and would then be done with.

WE are assured that an Electric Lighting Company in London is placing the conductors inside some houses directly into the damp wall plaster without any protection whatsoever. We most of us know how electric bell circuits act in a short time when cheap and nasty work has necessitated similar methods of running leads. Mr. Heaphy's attention might well be called to this little incident.

Sir WILLIAM THOMSON, in consequence of the recent fatal accident at the works of Messrs. Siemens Bros., where a labourer was killed by an electric shock, is going to issue a memorandum of instructions to users of his electrostatic voltmeters. A copy of these rules may be seen in our other pages.

WE learn upon very good authority that it is highly probable that the compound-winding case will not, after all, be carried to a higher court. While this, however, remains uncertain, the Anglo-American Brush Corporation has sent notices to the trade stating that it is not the Corporation's intention to collect royalties pending further consideration. Probably this was a wise decision to arrive at, for it is not likely they would have been paid under the present circumstances, and we have always felt that the claim for royalty would never have been generally put in force had it not been for the ill-advised action of Messrs. Siemens in the first place passively submitting to the demands of the Corporation.

IN the opening number of a new journal, the *Steamship*, Mr. G. J. Burns, B.Sc., assistant-surveyor to the R.E. Department, commences a series of papers on electric lighting.

IT behoves Mr. Preece to push forward his arrangements for the barrel of gunpowder experiment in which he is to take the active part. Everybody is now on the tiptoe of expectation, and the experimental details should certainly be in readiness for the next thunderstorm. Perhaps, however, Mr. Preece had something up his sleeve when making his now famous boast, and that his gunpowder after all is only tea. In any case, the matter is assuming dimensions which threaten to become serious if we may judge from an article in our own columns and the cartoon in this month's *Electrical Plant*.

THE fourth Edition of "Everybody's Pocket Encyclopædia" has been revised and enlarged. This compilation of things worth knowing ; things difficult to remember ; and tables of reference is about the cheapest and best sixpennyworth of which we know.

MUCH activity is manifest just now in electric lighting circles. It is evident that a great desire exists to introduce the most formidable competitor of gas into a number of towns in the United Kingdom, and this will doubtless be satisfactorily accomplished within a short period. We do not anticipate, however, that gas shareholders need be alarmed, for we believe that the progress of electric lighting will lead to a still greater development of gas consumption in many ways.

A GLANCE at our columns devoted to the registration of new companies will show that, as we have observed above, extraordinary activity reigns supreme in electric lighting circles. There were registered between Tuesday of last week and the same day of the present week, no fewer than 63 new companies, just one-third of which are connected with electricity. Twelve of these, for different districts, are promoted by the House-to-House Electric Supply Company, Limited, and the remainder are miscellaneous. During the electric craze of some years ago, we think that the greatest number of companies registered in any one week fell considerably short of those we chronicle elsewhere, but it is now necessary to register companies within a given period in order to obtain the Board of Trade license for this year. It will be noticed that amongst the objects of some of these companies is one to train and supply consulting electricians, engineers, and skilled workmen. Surely these are not altogether marketable commodities ?

THE following incident reminds one of the old saw of "The better the day the better the deed," for on Sunday last a river trip was organised by General Brine for the purpose of taking General Boulanger up to Hampton Court in the electric launch *Volta*. France's only General, unfortunately, or fortunately as the sequel shows, did not put in an appearance, but about twelve British generals and officers of rank were on board. On the return journey, after a sumptuous dinner, everything went well until about 9.30 in the evening, when the launch was run aground, below Hammersmith, on a sand bank in the middle of the river. The united strength and stratagetic manœuvres of our gallant defenders failed to release the *Volta* from her fearful position, and it was past three o'clock the next morning before the rise of tide enabled the brave voyagers to wend their way homewards. This record of a day's trip reads like a huge joke, though we are assured that the facts are precisely as we state them, but we cannot understand even now why this cockle shell of a vessel should have been left for five minutes hard and fast with such a capable crew on board. The steering at all events must have been erratic, but what can be expected with a "longshoreman" at the helm and pleasure at the prow ?

WE are afraid that English manufacturers find it exceedingly difficult to compete with foreigners for the supply of goods to the Continent, especially with Antwerp firms. We are informed that Edison dynamos and lamps can be delivered in Oporto, without any trouble to the purchaser, at a considerably less cost than English lamps and machines (for a similar output), can be bought here.

THE British Association will hold its meeting this year at Newcastle-upon-Tyne, under the presidency of Prof. William Henry Flower, F.R.S., commencing on the 11th, and ending on the 19th September. Every effort is being made to render the gathering successful, both in point of numbers attending and attractions offered to visitors.

THE *Surrey Comet* of June 29th contains several columns of correspondence relative to the proposed electric lighting of Richmond, Wimbledon, Hampton Wick, Surbiton, and the neighbouring districts. The most importment letter is from Mr. Daniel De Castro, who foreshadows the operations of the "South Western District and Thames Valley Electricity Supply Company, Limited." Mr. De Castro estimates that if the whole district can be secured current can be delivered in any part at 4½d. per unit, about equivalent to gas at 3s. 6d. per 1,000 cubic feet, and that the company can easily pay a dividend of 5 to 6 per cent., besides annually setting aside substantial sums as a sinking fund.

THE report of Crompton and Company, Limited, reads very well when we take into consideration that the company has only been just 12 months in existence, and doubtless the second year's result will be still more to the satisfaction of the shareholders. Certainly the outlook is to-day very much more encouraging to manufacturing companies than it was last summer, and everything points to a considerable strain upon the resources of electrical factories generally in supplying demands.

THE INVERSIONS OF POLARITY IN SERIES DYNAMOS.

Note by M. A. WITZ.

DYNAMO machines, when excited in series, are subject to reversals of polarity, which limit their usefulness, as this causes at times great inconvenience. Happening to come across a machine of extreme instability, we were led to study this curious phenomenon and investigate the causes of it.

The most simple case is when the series dynamos are applied to electro-chemical operations, especially to the charging of accumulators. When one of these generators supplies a certain number of secondary batteries, the magnetising is effected without difficulty, because the current, supplied by the incompletely discharged apparatus, is sufficient in general to determine the polarity of the inductors; the direction in which the armature must be put in motion is the direction in which it would turn under the action of this residual charge, if it was movable. The operation goes on very smoothly until the counter-electromotive force of the accumulators attains a certain value; then the slightest variation in the proceedings is sufficient to change the poles of the generator and reverse the nature of the current. This inconvenience is avoided by the employment of special coupling and disconnecting gear, and better still by exciting the dynamos in derivation.

These facts are known to all, but I have referred to them in order to compare them to analogous phenomena that I have observed in experiments on the transport of energy. For this purpose I employ two little dynamos of the Edison type, which are identical, and only differ in the mode of excitation: the generator is a series dynamo, while the receiver is excited separately. The machines having attained the rate desired, the difference of the electromotive forces $E - e$ remains constant, the resisting couple being itself constant. Now, let us diminish the effort to be overcome; the receiver accelerates its pace, and, the inductive fields being equal, it tends to take the same speed as the generator; at the same time the counter-electromotive force, e, increases and the intensity of the current decreases in consequence. At this moment the slightest variation in speed is sufficient to reverse the poles of the generator, and I then see the receiver take a periodic alternating movement, performing indefinitely some turns to the right and some to the left with astonishing regularity.

This alternation in the rotations will be the better obtained the more rapidly the receiver is discharged, the greater the speed that it takes, and the more intense the field that is excited between the poles. It can be avoided by reducing the field so as to prevent all augmentation of speed. The same results are obtained by employing a magneto as receiver: with a series dynamo I only observed one demagnetisation of the generator, and therefore one stoppage of the receiver; all this was easy to foresee.

But this is the most singular point about this periodically reversed rotation. After the receiver has provoked by its reaction the reversal of the poles of the generator, it first exhausts the energy of its flywheel, then its speed changes its sign; it then turns in the opposite direction, until its speed is sufficient to reproduce the phenomenon. Now this speed is relatively slight; I have measured it by means of a vibrating diapason, which inscribed its vibrations on a disc placed on the axle; it is much less than that which would be necessary for the counter-electromotive force to become equal to that of the generator, as the following figures show. The generator making 1,781 revolutions, the receiver took a maximum speed of 252 revolutions; the receiver being held, the 1,781 revolutions of the generator gave 10·3 volts, and the generator being held, the 252 revolutions of the receiver could only develop 0·98 volts, that is to say the one-tenth at the outside.

I propose to explain this fact in the following manner, which also applies to the charging of the accumulators. Let us construct the external characteristic of the generator. We will take through the origin of the co-ordinates a straight line, O, A, making with the axis of the x an angle, a, so that its tangent may be equal to, R, the total resistance of the circuit. This being done, let us trace a tangent to the characteristic parallel to the straight line, O, A; it cuts the axis of the y's at a point, B. The point of contact of the tangent to the characteristic gives the value of the electromotive force, E, of the generator at the moment of the inversion, and the ordinate, O, B, marks the counter-electromotive force, e, of the receiver capable of producing this inversion. The value of e will be less as the total resistance, R, is more considerable; on the other hand, we see that diminution of speed in the generator will lessen the characteristic and hasten the moment of the inversion; this is what we observe in reality. We may remark, also, that an increase of speed in the receiver increases the apparent resistance of this machine, and, consequently, also the total resistance, R. Lastly, let us prolong the tangent to the characteristic as far as its meeting with the symmetrical branch of this curve. The ordinate of the point of intersection gives the value of the electromotive force developed instantaneously after the inversion of the rotation and the reversal of the poles. We then sum up the facts observed, and the agreement between the values thus obtained and the figures arrived at experimentally is such as to enable us to think this explanation is perfectly justified.—*Comptes Rendus.*

PRECAUTIONS FOR SAFETY IN THE USE OF SIR WILLIAM THOMSON'S ELECTROSTATIC VOLTMETERS IN CONNECTION WITH DYNAMOS, WHETHER FOR DIRECT OR ALTERNATING CURRENTS.

SEC. 1. In all applications in which one of the two conductors connected with the voltmeter is kept permanently connected with the earth, this conductor should be connected with the outer case of the voltmeter. The other conductor is to be connected with the insulated terminals and must be carefully guarded against accidental contacts.

Sec. 2. To provide for use in any application not fulfilling the condition of sec. 1. All the electrostatic voltmeters are supplied with thoroughly insulating feet: and the precautions stated below in sec. 3, 4 must be observed.

Sec. 3. The vertical scale voltmeter for from 400 to 12,000 volts, when set up for permanent use, should be enclosed in a case (which may be of wood with a glass front), preventing any person from accidentally touching the metal case or the terminals of the instrument. The vibration checker is worked with perfect safety by a silk cord passing through a hole in the wood or glass of the protecting case to the front outside.

For temporary or experimental applications the user must take his own precautions: an outer enclosing case might be found too cumbrous.

Sec. 4. For ordinary domestic electric lighting, or other applications to less than 200 volts, the multicellular voltmeter may be left unprotected, so far as personal danger is concerned; but to avoid chances of damage to instruments or wires, or of melting a fuse, its outer case as well as its terminal insulated from the outer case, ought to be perfectly guarded against accidental contacts, when the instrument is set up for permanent use. Glass and vulcanite sheaths are provided for this purpose by the instrument maker when desired.

Sec. 5. *General Warning.*—Never open the case of the vertical-scale voltmeter to change the weights, nor touch its terminals to connect or disconnect (or to secure either connection if imperfectly made), without being sure either that the dynamo is not running, or that both the conductors leading to the voltmeter are safely disconnected from its circuit.

Sec. 6. It may be asked, with reference to the vertical-scale voltmeter, Why is the inner case made of metal? The answer is, that the electric conditions for definiteness of measurement, require the wave to be protected from sensibly disturbing influence of any substance other than the air around it, differing in potential from itself, unless at the same potential as the quadrants. Why, then, not coat the metal inner case with wood or vulcanite, or other non-conducting material? Ans. The protection thus imagined might be delusive when 10,000 volts is dealt with. Safety is most surely secured by an outer case an inch or so from the inner metal; unless, *which is always best when it can be arranged for*, one of the conductors is kept connected with the earth, and with the metal case of the electrometer also connected with the earth.

WILLIAM THOMSON.

THE PRESENT POSITION OF THE ELECTRIC LIGHT IN PARIS.

[A COMMUNICATION.]

THE question of the electric lighting of great cities has now become such a prominent one, and especially in London, since the holding of the Board of Trade inquiry by Major Marindin, that we offer no apologies to your readers for placing before them the following latest and exhaustive details on the electric light as it is at present installed in Paris.

Three companies have installed electricity on the boulevards. The companies which share this lighting are:—The Popp Company, the Edison Continental Company, and the Transmission of Power by Electricity Company. The Popp Company has charge of the section comprised between the Place de la Concorde and de l'Opéra. It possesses at Saint Fargeau a large central motive power works (4,500 horse) for compressed air, which is canalised in Paris. It has also a large number of small provisional electro-motor stations, most of them for theatre and private lighting, among which are the following:—1. Place de la Madelene; 2. Rue Meyerbeer; 3. At the Montagnes Russes (switchback railway); 4. Boulevard des Capucines, No. 5; 5. At the Eden Theatre; 6. At the Variétés; 7. At the Bourse du Commerce; 8. At the Château d'Eau; 9. At Bataclan; 10. At the Magasins du Travailleur. Three large works are in view to replace them: the first, in the Rue Boissy d'Anglas, near the Madeleine, is expected to be ready in two months; another is projected near the Bourse du Commerce; and the last, of 2,000 horse-power, in the Rue Royale, which will be more specially destined for arc lamp lighting. Each will be capable of feeding 20,000 lamps. These will be joined, and the current will pass through accumulator batteries which are intended to prevent variations and extinction in case of accident. The compressed air receivers generally have a force of 50 horse-power, sometimes 100. One receiver works a Thomson-Houston dynamo which feeds 30 to 50 Thomson-Houston arc lamps by continuous high tension currents (30 ampères, about 2,500 volts) with Gramme dynamos as exciters. This company employs Faure-Sellon-Volckmar accumulators. The canalisation is made in metal tubes, with India-rubber joints placed in trenches at the necessary depth. The cables, of small diameter, are composed of copper wires covered with India-rubber canvas in a layer of India-rubber, and enclosed in leaden pipes. They are laid freely in the conduits without supports, and may be drawn out by traction. The section of the cable is calculated per 10 ampères, and it is insulated for 2,500 volts. Draft-holes, placed at about every 50 mètres, have permitted the introduction of the cables into the conduits. A commutator in each draft-hole gives the facility of cutting off the current which feeds a corresponding candelabra. The shape of the Thomson-Houston lamps is elegant: they are composed of a sort of lyre, which bears a spherical globe and a reflector, and a cylindrical muff, which encloses the regulating apparatus. The candelabra, of a model only adopted by the City of Paris, are 6 mètres high, slim in shape, moulded and bronzed. They are installed either on rounded refuges, 4 mètres long by 1 m. 70 wide, or on the edge of the footways. In the Rue Royale they have been disposed in quincunx. Their distance varies from 30 to 50 mètres. Since May 24th the boulevards have been lighted by the electric light by the Popp Company, from the Place de la Concorde to the Place de l'Opéra, by means of 44 arc lamps.

The Edison Company, to which the Palais Royal station belongs, possesses another factory situated in the Rue du Faubourg Montmartre, known as the Drouot station. This works is to serve the Grand Boulevards from the Place de l'Opéra to the Porte St. Denis. It already supplies 4,200 incandescent lamps for private service by an aerial canalisation, in which a current of 1,600 ampères is furnished by two Edison dynamos commanded by two Weyher and Richemond horizontal engines of 150 horse-power each. Since May 24th it has lighted by electricity the *salle* of the Folies Bergères by means of 520 incandescent lamps and 34 arc lamps, through a subterranean canalisation which is the beginning of an intended circuit in the Faubourg Montmartre. In this connection a Corliss engine of 800 horse-power works two Edison dynamos of 800 ampères. Its boulevard canalisation, which is in course of execution, will comprise branches in the principal neighbouring thoroughfares: the Rue Richelieu, Rue Vivienne, Rue Taitbout, Rue du Helder, Faubourg Poissonnière, Rue Halévy, Rue de la Chaussée d'Antin, &c. 6,500 ampères at 120 volts will be produced by the Edison dynamos, worked by 1,600 horse-power—300 of which are held in reserve—engines which are being installed in the same central station of the Faubourg Montmartre. 10,500 kilos. of steam will be furnished by four Babcock and Wilcox boilers, and 8,500 by four Belleville boilers. The Edison Company's cables are formed by 30 to 40 silicious copper wires, supplied by the Lazare Weiller firm, which are twisted in one or several strands. They have no covering; they are supported by porcelain insulators and pressed on their stays by pressure screws. The vertical insulators are made fast in a conduit of mortar and cement, established at a small depth under the pavements. In passing the transversal streets, the cables descend into a shaft about 0 m. 75 in diameter, several mètres deep, furnished with steps, pass under the sewers, and remount on the other side of the street in a similar shaft. The secondary wires are laid in an insulant and in a leaden tube when they leave the collector conduit and when they no longer repose on insulators. The circuit comprises 38 arc lamps; each lamp takes 10 ampères. Two lamps are placed on 100 volts; they are of the Pilsen system. The interior aspect is that of a large lantern formed of two cone trunks, the lower cone of rough glass, the upper of metal. The candelabra are placed on refuges, in the middle of the road. The canalisation works are nearly finished, but the central station is not yet quite ready to furnish the current.

The Transmission of Power by Electricity Company (Marcel-Deprez system) has its central works at Saint Ouen. Besides this it has set up stations at the Rue Filles Dieu and Rue de Bondy. The Rue de Bondy station at present supplies the following theatres:—The Ambigu, the Folies Dramatiques, the Porte St. Martin, and the Renaissance. For this lighting it has two semi-fixed horizontal Weyher and Richemond engines, each of 70 horse-power, which work four Breguet dynamos and 250 ampères and 120 volts; and two Lecouteux engines, of 70 horse-power each, working two Thury (Switzerland) dynamos, of 500 ampères and 120 volts. In order to assure the lighting of the section of the Grand Boulevards, from the Porte St. Denis to the Place de la République, this company is going to place in this same station four engines of 200 horse-power, which would feed 25 arc lamps of the "French Company's homogeneous lamp" system. It uses cables analogous to those of the Edison Company, but of stronger section, and formed of a larger number of strands, 50 to 60 wires. The insulators

are a little different, and the conduits are 0 m. 60 by 0 m. 50 in size. This company's work also is not yet completely finished.

Let us add, as another detail as to the electric light in Paris, that the express boats on the Seine, which are employed in the Exhibition service, have for some months now been lighted by electricity. A special steam engine of four to five horse-power works a continuous current Breguet dynamo. Both are placed symmetrically on each wall of the keel. The current produced feeds 17 incandescent lamps, which give light to the engine room, to the interior saloons, and to the fore and aft lamps.

Lastly, much has been said of the recent installations at the Elysée. The installation of the electric light carried out by the Continental Edison Company is the first in Paris in which secondary transformers have been used. In preceding years the grand official balls given at the Elysée were alone lighted by electricity. It was then necessary to have a temporary installation, to use accumulators, and then to remove the whole to begin again afresh the next time. M. Carnot, having taken into consideration the inconveniences of this arrangement, decided to make a definite installation which would serve for the whole of the receptions. It being deemed unadvisable to introduce steam engines into the palace on account of the trouble it would cause, and also because it would involve the employment of a special staff, recourse was had to secondary transformers, which permit of electric lamps being fed from a distance. The Edison Company, to whom the contract was given, therefore installed at its Palais Royal works a Zipernowsky dynamo of alternating currents, with which it supplied the transformers placed at the Elysée. The canalisation between the Palais Royal and the palace was composed of two copper cables, perfectly insulated, and fixed in the vault of the sewers. These cables were made at Bezons, in the workshops of the General Telephone Company, whose facilities allowed them to establish them in less than 15 days. The transformers of the Zipernowsky type, 12 in number, are connected in parallel on these two cables; the tension on the primary circuit is about 1,800 volts. Each transformer feeds a special circuit of distribution, on which the incandescent lamps, of 44 volts each, are joined according to the three-wire system of Edison. The electric light, which numbers about 2,000 incandescent lamps, is installed in the *salles de fête* and in all the rooms on the ground floor; the lamps being fixed in the lustres, &c. The light, which is of remarkable steadiness, shows off the richness of the furniture, the tapestry, and the decoration of the *salles* splendidly.

STUDY OF THE DURATION OF LIGHTNING.*

Note by M. E. L. TROUVELOT.

IN an article published last year,† I asserted that lightning has not the instantaneity generally attributed to it, and, in support of this assertion, I reproduced in my note a photograph obtained during the storm of the 22nd July, 1888. This photograph showed the lightning in the form of a wide vertical band with numerous parallel strokes, and formed of numberless horizontal striæ. This singular appearance of the lightning I attributed to the horizontal movement that I imparted to the apparatus during the time of pose.

This simple manner of explaining the phenomenon, however, gave rise to many objections on the part of several distinguished *savants*. It would have been easy for me to reply to these objections and show their weak points, but as I had in hand palpable facts, I preferred to let these facts speak for themselves, feeling convinced that they are unanswerable.

I will now give these facts: On the 22nd of July last, I saw on the horizon at Paris a brilliant flash of lightning, which seemed to me to last several seconds, during which it showed several fluctuations in brilliancy, and seemed as if it were the product of an oscillating luminous electric current of very variable intensity. Convinced by this observation that the lightning could not always be instantaneous, and wishing to obtain a palpable proof that it is not, I immediately directed my photographic apparatus to the same part of the heavens, taking care to impart to it a slight horizontal backwards and forwards motion during the pose. I had not to wait long. A flash appeared, and the development revealed the manifold forms already described, which I have the honour to submit to the Academy.

On the 7th of June last, a far-off storm gave flashes weakened by the rain and mist. The apparatus was directed to that part of the sky where the flashes appeared most frequently, and during the pose I imparted to it a somewhat rapid horizontal swinging movement on its axis. From rather a high point above the horizon appeared a flash, which spread out on each side, forming several horizontal branches. The development showed it with its wide horizontal striæ parallel to the direction of the movement imparted to the apparatus, having the appearance of a light streamer waving in the breeze.

We will not dwell more at length on the meaning of this representation, for, in our opinion, it indicates sufficiently that lightning has an appreciable duration, if not in all cases, at least in some; and consequently the Wheatstone experiments, which only give to a flash the duration of $\frac{1}{1000}$ of a second, are somewhat in error.

If this last photograph of the flash still left any doubts as to the appreciable duration of a flash we might add that a peculiarity of detail in our plate of the 22nd July, 1888, which at first escaped notice, shows clearly that the multiplication of the fulminating stroke results from the displacement of the apparatus during the duration of the flash. In fact the little cloud which, towards the bottom of our photograph, traverses the multiplied flash is doubled on the plate in consequence of the displacement undergone by the apparatus during the pose; and the displacement, measured on the inequalities of the edge of each image, is absolutely the same as that which the flash has undergone.

As we showed above, it is not only by means of the photographic plate that we can prove that lightning has an appreciable duration; the eye itself is capable of appreciating this phenomenon, as we were able to prove on the 7th of June last. In fact, a flash coming from a part of the sky hidden by a building soon shows several branches in the part of the sky that is visible. Now, it could be plainly seen that these branches advanced progressively in the sky; they could be followed by the eye as easily as the progressive expansion of an electric spark on a plate of glass or ebonite. Moreover, the numerous plates that we now possess enable us to assert that electrical discharges are not made instantaneously, but progressively, on photographic plates.

GANZ'S STANDARD SCREW THREADS.

MESSRS. GANZ & CO., of Budapest, hand us the following particulars of their new standard screw threads, remarking that of the different systems of screw threads which have been proposed for large machines, only those of Whitworth and of Sellers have been accepted in practice, the former being used chiefly in Europe and the latter in America. Though a very remarkable unanimity has taken place in the use of these systems, it is quite different with the thread scales for instrument makers and mechanics. Every manufacturer has his own thread, and, besides, there are very often several different screw plates in use in the same workshop. The natural consequence of this is, that gene-

* *Comptes Rendus.*
† *La Lumière Electrique*, Vol. XXIX., p. 254.

rally the screws which are supplied by the screw manufacturer do not fit the home made nuts. Most of the threads for instrument makers which are at present in use have besides a pitch too high in comparison with their diameter. Some of the manufacturers endeavour to obviate the want of delicacy of their screws by making the angle of the thread section very small, and by even forming concave side faces in the section. It is obvious that this method of manufacture renders the thread too weak.

To evercome these objections Messrs. Ganz & Co. have introduced in the workshop of their electrical department a new thread scale which answers all practical requirements. All the threads have a sectional angle of 40°, and the following table gives the diameters and number of threads to the inch. The former are given in millimetres and range from 1 mm. unto 20. The increase in diameter on screws from 1 mm. to 4 is 0·5 mm. from one screw to the next one, and 1 mm. on screws from 4 mm. of diameter upwards, the number of such steps being therefore 23. The number of the screw is given by the tenfold of the diameter, number 25 being a screw of 2·5 mm. and number 180 a screw of 18 mm. diameter.

No.	Diameter in mm.	Number of threads on inch.	No.	Diameter in mm.	Number of threads on inch.
10	1	100·3	100	10	21·3
15	1·5	80·1	110	11	20·0
20	2	65·1	120	12	19·1
25	2·5	54·9	130	13	17·3
30	3	50·0	140	14	16·0
35	3·5	45·0	150	15	15·0
40	4	39·0	160	16	14·0
50	5	34·9	170	17	13·0
60	6	32·5	180	18	12·8
70	7	27·4	190	19	12·2
80	8	25·9	200	20	11·6
90	9	24·0			

CONTINENTAL NOTES.

ACCORDING to a German contemporary the telephone nets of the world were as follows last year :—United States, 750 nets, with 200,000 subscribers ; Germany, 167 nets, with 26,000 subscribers ; England, 125 nets, with 20,000 subscribers ; Sweden, 150 nets, with 15,000 subscribers ; France, 39 nets, with 10,800 subscribers ; Italy, 49 nets, with 9,600 subscribers ; Switzerland, 71 nets, with 8,000 subscribers ; Russia, 36 nets, with 7,600 subscribers.

Recently some experiments with the electric light have been carried out by the Russian artillery, in order to ascertain whether the light is favourable or prejudicial to field operations. The experiments were as follows :—1. Search lights to ascertain the enemy's position. For this experiment a sharp concentrated light was used, the object being to ascertain the colour, movement, or position, of objects in the light. 2. Lighting operations in a fortress at night, without the latter being visible to the enemy. 3. Light for dazzling the enemy's gunners. All the experiments resulted in a unanimous verdict in favour of the electric light.

Thanks to the action of the Russian government the telephone is making but little progress in Russia ; every hindrance is placed in the way of telephonic enterprise. Thus every subscriber has, in addition to the fee to the company, to pay a tax of £5 a year to the government, whilst the promoters are charged upwards of £1,000 for each installation a year. In fact, recently, in Reval, the starter of a telephone was glad to leave the city and his whole plant. Every telephone company in Russia has to submit a list of its subscribers to the police, and give notice of each new one, and the latter has the option of striking off any one. Moreover, the companies have to make such arrangements that any conversation can be overheard by the police if desired. The government is, in fact, for obvious reasons, against the extension of the telephone. There is, therefore, not the slightest chance of the projected French company obtaining a concession for a telephone between St. Petersburg, Warsaw, Moscow, Berlin, and Paris.

A telephone is being laid between the towns of Hanover and Hamburg, on the condition that its working is guaranteed for two years. There is already telephonic connection between Kiel-Flensburg and Bremen-Lübeck.

The recent experiments with field telephones in the Prussian army have proved so satisfactory that the ministry of war has ordered these instruments to be supplied to all army corps.

The Belgian government has appointed a commission, the object of which is to study the applicability of electricity for mining purposes, such as the firing of explosives, lighting of mines, electrolytical extraction of metals, emptying, and airing of mines, &c.

The *Semaine des Constructeurs* of Paris states that the electric conduits of the great Boulevards, from Porte Saint Denis to the Grand Hotel, are nearly finished, conformably to the requirements imposed on electric companies. The conduits are about 5 feet high and 2 feet 6 inches wide, of masonry lined with cement, are built under each foot pavement parallel to the direction of the boulevards, and united by occasional lateral galleries. The wires are unprotected, and only insulated by porcelain knobs.

The well-known firm of electrical engineers in Vienna, Messrs. Egger & Co., have proposed to the Seel factory of Berlin jointly to found a large factory for the manufacture of glow lamps in Austria, capable of turning out 600 lamps a day.

Last winter in Austria the telephone companies suffered great losses through the breaking of wires by the accumulation of snow upon them, and in consequence corps of snow-clearers have been formed, which have effected a great saving.

The *Elettricita*, of Milan, states that the central station in that city now numbers 1,075 glow lamps of 8 candle-power, 4,839 of 10, 6,817 of 16, 158 of 32, and one of 50 candle-power, 227 arc lamps of Thomson-Houston construction, and 152 of Siemens's construction. The total number of lamps fed is, therefore, 12,890 glow and 379 arc lamps. There are also a number of subscribers using the current for mechanical purposes. In the latter case the cost is 40 centimes per horse-power hour. "Is it permissible to shrive by telephone?" is the question that is agitating the Catholic world. In order to decide the question a conclave of ecclesiastics has been sitting in Rome, it having been raised by an abbot of Faenga in a work "Praxis confessiones," who decides in the negative. In this the conclave has fully concurred. However, nothing is said whether the blessing of the Pope is ineffectual if conveyed by the same agency.

The telephone and the electric light is making some progress in other parts of Africa than the Cape. Thus on the north-west coast, at St. Paul de Loanda, a telephone net has just been completed with 100 subscribers, whilst in the French possessions, Russifique and St. Louis, the streets are lighted by electricity, to the great wonder of the natives. In the former place Edison glow lamps are used within and without doors, and in the latter Jablochkoff arc lamps. Central Asia, too, will soon boast the light, Russian engineers being busy with an installation at Bokhara, by order of the Emir.

Perhaps the heaviest telegram bill in the world is that of the Chinese Envoy at Washington, Chan You Woon, who regularly pays 1,000 dollars a week for his despatches to China, the representative of the Celestial Empire using a cipher which costs 4 dollars a word.

A curious telephonic experiment was made the other day by a physician residing at Vormsund, in Norway. Being away from home, he had his dog, an English setter, brought to the telephone, and calling it, the dog answered by barking. The distance was nearly 100 miles.

LIGHTNING CONDUCTORS.

By S. ALFRED VARLEY.

(*Continued from page* 715.)

I PROCEED to consider what is involved in the assumption that a Leyden jar discharge is oscillatory.

The subject of oscillations was treated at some length in my article of last year; it was there stated that oscillations involved inertia, and inertia involved matter, that motion might be regarded as a combination of an external force with matter, time being required both for its absorption as well as for its dissipation; that overcoming inertia was simply a storing up of energy in matter, and when oscillations were set up as a consequence, these oscillations continued until the whole of the energy had been dissipated by its conversion into some other form of energy.

It was also suggested that matter and force formed a mysterious duality, that force was always found associated with matter, and our cognisance of its existence was solely through the medium of matter, which might be regarded as the home of force; that where there was no matter there could be no electricity, no magnetism or force of any kind; and further, such reasoning seemed to indicate that for force to be transmitted through what is called space, a medium of some kind was necessary as a vehicle of its transmission. At the same time issue was joined with our mathematical physicists in reference to the ethereal jelly theory; it was stated that in the opinion of the writer the existence of such a medium should be regarded as a hypothesis only, which our present imperfect knowledge seemed to require, whereas many of our mathematical scientists would appear to regard the ether jelly theory almost as an article of faith, something as concrete to their minds as matter itself, and affording as sound a substructure on which to erect theories and hypotheses.

Wheatstone's observations will be generally admitted to demonstrate the dual character of the electric forces; the + and − electricities at each end of a path of discharge starting at the same time *identically* and meeting one another. Wheatstone's observations also receive confirmation incidentally, from the interesting fact mentioned at the Bath discussion, where the first and last horse only, of a number standing in a row, were killed by a lightning discharge presumably passing through the whole of them. The first and last horse forming the two ends of a path of discharge received + and − discharges of equal amount, and a considerable portion of such discharges was diverted through their legs to the earth, and consequently the intermediate horses escaped with their lives.

The analysis of Wheatstone's observations, given in an earlier portion of this article, demonstrates in the writer's opinion, most conclusively, that discharge through air consists of a rapid series of discharges proceeding by stages and breaking down the layers of molecules one after the other. Apart, however, from such demonstration, the supposition that Leyden jar and lightning discharges are oscillatory seems to be quite untenable.

To begin with, it is very difficult to understand that two opposite forces rushing together and uniting can set up oscillations, for it involves their separating again so soon as they have united. Where is the force necessary to accomplish such separation to come from; their attraction for each other has been just sufficient to overcome the resistance which stood in the way of their union, and it is assumed that after overcoming this resistance they strike one another with such violence that they separate again, involving the breaking down fresh resistance and overcoming magnetic inertia at each alternate oscillation.

If electricity were a single force, instead of being a dual one, then it might not require so great a strain on one's reasoning powers to assume the possibility that Leyden jar discharges were oscillatory, and it is even conceivable with a dual force that oscillations may be set up under certain conditions, but such oscillations can only occur at the antecedent stage to conduction, viz., induction. Whenever actual discharge has been brought about, and the two opposite electricities have united, it is *absolutely* inconceivable that the very force which has effected their union should separate them again immediately afterwards.

Prof. Lodge admits that oscillations involve inertia. Where does it exist in the case of the assumed electric oscillations? The only thing known to possess inertia is matter, and the inertia matter possesses is simply an expression of its relation, either to terrestrial or to magnetic gravity. Inertia overcome is a storing up of energy in the molecules of matter; such storage of energy may be brought about either by magnetic or terrestrial gravity, and the specific gravities of the various forms of matter expressed in terms of their relationship to magnetic gravity differ among themselves much in the same way as bodies vary in their relationship to terrestrial gravity. When a Leyden jar is charged or statical charge occurs in the clouds and the earth, it is the resistance the path of discharge opposes that determines the degree of potential of the statical charge necessary to bring about discharge.

If the bob of a pendulum be raised on one side of its point of suspension and set free, it oscillates backwards and forwards on either side of the point of suspension; and if a glass ball be allowed to fall on to a block of glass or other hard substance, it will rebound and oscillate up and down. For reasons unnecessary here to refer to, a pendulum bob under the most favourable conditions for oscillation, when raised and liberated, never rises on the opposite side of the point of suspension to the same height as that from which it started, and the glass ball, similarly, does not rebound to so great a height as that from which it was dropped.

Now for a Leyden jar discharge to be oscillatory each successive oscillation, has to pass through the whole length of the path of discharge and to overcome resistance at each alternation. Prof. Lodge says that the energy associated with a lightning discharge must not be overlooked, and he states this energy becomes dissipated by oscillations and surging of the electricity through a resisting medium; undoubtedly the energy must be dissipated, but the energy associated with a statical charge is determined by the resistance of the path of discharge, and is accounted for by breaking down such resistance.

It is well known that to increase the speed of a rifle ball twice, involves the expenditure of four times the energy, and that its power to break down resistance is as the square of the velocity.

Electric motion will be found to harmonise in every particular with what is observed in the case of a rifle ball; to raise the potential of a statical charge twice, requires an expenditure of four times the energy, and the power of such charge to break down a dielectric is also as the square of the potential of the statical charge.

In the example of the rifle ball the energy associated with it becomes dissipated by breaking down resistance opposed in its path, and the resistance overcome balances the energy parted with, and becomes converted into heat. It is the same in the case of a lightning discharge. So soon as the energy stored up in the statically charged clouds, and the earth exceeds in the slightest degree the resistance opposed by the dielectric to the union of the accumulated + and − electricities, the stored up energy breaks down the dielectric, the whole of it becoming dissipated in the act of doing so, and converted into heat similarly to the rifle ball when performing work, consequently there is no free energy left to be accounted for.

The question whether Leyden jar discharges can be considered to be oscillatory has now been exhaustively discussed from more than one point of view, and the writer thinks that even Prof. Lodge will have to acknowledge the points in dispute have been fairly met and reasoned upon, and that nothing has been slurred over or explained away. He has started in his analysis from elementary and accepted facts, and has built up his reasoning brick by brick and stage by

stage, never losing touch with the base forming the substructure on which electrical science has been raised. He has supported his contentions, and in his opinion, greatly strengthened the position taken up by pointing out the continuity of electrical phenomena, as well as the harmony and parallelism which exists between the forces of nature, and he has endeavoured to show how much the Franklin-Faraday theory accords with established facts of physical science generally.

A few words seem necessary with respect to the speed at which electricity travels. Both Wheatstone and Maxwell seem to regard electricity as travelling at one uniform rate, something like light does. Wheatstone concluded the rate to be 288,000 miles per second, and Maxwell considered it to travel at or about the same speed as that of light.

Wheatstone evidently did not by any means grasp the full significance of his very important observations. Faraday grasped the question of rate of speed more fully, but he never seems to have developed it. He contented himself by simply pointing out that had Wheatstone connected the two outer extremities of his two coils of wire, one with the inner coating, and the other with the outer coating of a Leyden jar, that the central spark observed in the revolving mirror would have occurred considerably later than Wheatstone actually observed it. The speed observed by Wheatstone was only true under the precise conditions in which his experiments were carried out. An electric impulse travels at all speeds from the infinitely slow to the infinitely great. The rate of an electrical discharge must, according to the Franklin-Faraday theory, be instantaneous under certain theoretical conditions not practically attainable. For example, if the links of a chain are of uniform strength, and this chain be subjected to stress, all the links would, theoretically, give way at one and the same time, whatever might be its length. In such statement the action of gravity, or any other disturbing element is, of course, overlooked. In the same way, if a Leyden jar discharge occurred through a conductor of uniform sectional area throughout, and suspended in space so that there could be no diversion of energy laterally by induction between the conductor and external matter, the discharge would be instantaneous, whatever might be the length of the conductor; the influence of magnetic inertia under such assumed conditions would only have the effect of prolonging the act of discharge. In practice, the greatest speed we are familiar with is that of a lightning or a Leyden jar discharge, and the slowest that of a long submarine cable.

The above facts militate, in the writer's opinion, against Clerk Maxwell's electrical theory, but they are by no means the only facts that seem to do so.

I proceed to say a few words in reference to the supposed lateral surgings of lightning discharges. Prof. Lodge says if any one were touching a conductor at the time a lightning discharge occurred through it to the earth he would probably receive a very severe shock. I think Prof. Lodge is practically right, but I attribute the shock he probably would receive to other causes than that of surging. Mr. Preece has expressed an opposite view, and says he is quite prepared in the cause of science to try the experiment in his own person, or to sit upon a barrel of gunpowder with a conductor passing through it. The Chief Electrician of the Postal Telegraph Department, sitting on a powder barrel during a raging storm, gravely, but at the same time calmly, pondering through his spectacles the 35th verse of the 38th chapter of Job, would undoubtedly be a sight for the gods, and would form a good subject for a companion picture to the one issued by *Electric Plant* after the Bath meeting discussion, where a Gladiator, armed with experience and half a million lightning conductors, is represented with one foot on a prostrate opponent and confidently appealing to an appreciative audience whether he shall slay or spare;*

but what I want to point out is that there is no real necessity for such heroic experiments, as the matter in dispute can be determined with the greatest facility in the laboratory without even the risk of catching a cold.

I myself never have had 500,000 lightning conductors under my charge; as a matter of fact, I have made only one good observation, and this was as far back as 1856. What I then observed, however, afforded matter for study and reflection for some years; among other things, it directed my attention forcibly to magnetic inertia, and led me to the designing of my lightning bridge;† but although I have not been so highly favoured as my at one time colleague, Mr. Preece, I think I may venture not only to tell him how the experiment can be easily tried, but I think I may go so far as to anticipate the results likely to be obtained.

If he charges a small Leyden jar, holds it in one hand and discharges it by an uninsulated metal discharger, the probability is he will experience no shock, but if he repeats such experiment with a very large jar the probability is he will experience a slight shock, let him take now the small jar and wrap the outer coating with a layer of tissue paper, grasp and discharge the jar as before, however small the jar may be he will now receive a shock.

Take a thick tubular conductor of some length, and thread through the interior a well insulated wire, bringing it up on the outside and through the centre again, so as to make several long convolutions. If the two ends of the insulated wire be grasped by the hands at the time a Leyden jar is discharged through the conductor he will experience a shock, and the greater number of times the insulated wire is threaded through and over the outside of the tubular conductor the stronger will be the shock.

Now, if any one should be touching an earthed conductor at the time it was struck by lightning he would run the risk of receiving a shock from two causes—he would be liable for the same reason as when a discharge occurs through a thin layer of paper surrounding the metal coating of a Leyden jar, and also from the secondary current induced as a consequence of the magnetic inertia of the conductor, and of which the above-mentioned tubular conductor threaded through the inside and over the outside with convolutions of insulated wire is an illustration.

It is difficult to obtain a sufficiently perfect connection with the earth, such as is needed to completely carry off all at once such a sudden discharge as that of lighting, for the earth owes its conducting properties to small molecules of water diffused through it, and these become polarised on the surface of the earth plate,

* The whole of the above continuation of the article was set up in type for last week's issue, but, as stated in "Notes," it had to be left over from want of space. In the meantime, curiously enough, *Electric Plant* has issued a cartoon somewhat on the same lines as those suggested in the article; their Artist cannot, however, be congratulated upon having risen to the occasion, for it is scarcely complimentary to an engineer of over thirty years' experience, a Member also of the Council of the Royal Society, whose propriety of manner and gravity of demeanour is so irreproachable, to represent him as a dapper, light hearted young man, with his hair parted in the middle and a neatly trimmed beard, grasping in one hand what looks like a huge cigarette, and laying hold of a lightning conductor, passing through powder barrels, with the other; so to depict a scientist, the deep yearning of whose great soul and zeal for truth is such, that he regards lightly the sacrifice of a life if only thereby he can advance scientific knowledge, seems little short of a libel.

† These lightning bridges consist chiefly of carbon powder and act in a similar way to the carbon microphone, which they preceded; they oppose a decreasing resistance to an increasing potential, ranging from a resistance as high as 50,000 or more ohms to working currents, down to a resistance as low as 6 ohms to currents of high potential, such decrease of resistance being brought about by electrical pressure. A number of these bridges are still doing duty. The Bristol and Exeter Railway Company have 110 of them, the greater part of which have been successfully working now for 22 years. There were also some thousands of them fitted to instruments in the Postal Service, but they did not there receive the consideration which their introducer considers they deserved. The writer believes he is largely indebted to Mr. Preece for the treatment they met with in the Postal Service; as a high priest of electrical monopoly, he was able to do in the case of the lightning bridges what he (Mr. Preece) urged at the Court of Sessions, Edinburgh, should be done with my compound-wound dynamo of 1876, viz., "throw them on the dust heap."

causing resistance by reaction; and even if the lightning conductor be also connected to a length of water pipe, there is the magnetic inertia to be overcome, causing a momentary resistance, and, owing to the above mentioned causes, a general diffusion through all and every conductor available occurs; and I would therefore advise Mr. Preece, should he decide to try his heroic experiment, to insure his life largely, so that funds might be forthcoming to erect a monument to A MARTYR OF SCIENCE.

(To be continued.)

A SYNTHETIC STUDY OF DYNAMO MACHINES.

(Continued from page 650.)

VI.—ARMATURES IN PRACTICE—*(continued)*.

THE armature coils instead of enveloping the ring core by long turns taken round the exterior and crossing at the ends, in fig. 105, may be wound round the core inside and outside, as in fig. 111. Here there are two

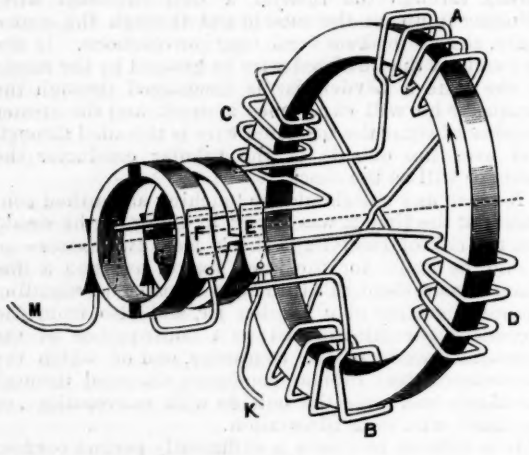

FIG. 111.

coils having positions on the armature at right angles to each other as formerly, but each coil is now divided into two sections, A and B constituting one coil and C and D the other. The two commutators belonging to these, with their respective pairs of brushes, are clearly shown, the coil, A, B, being connected to the inner commutator, and the coil, C, D, to the outer one. A, B is supposed to be in the position in which the direction of the E.M.F. is reversed, while C, D is consequently in the position of maximum activity. The current flows through the two coils in series, passing by K from one binding post to the brush, E, through the coil, A, B, to brush G, from G to F and through coil, C, D, to brush H, whence it flows by M to the magnet coils, afterwards to be led to the second binding post. Although in the fig. the plates of the commutators are shown cut on the straight, in order that the circuit may not be broken it is necessary when the coils are in series to cut the segments on the angle or to let them overlap, as already shown in fig 106.

In considering the E.M.F. induced in a frame rotating in a uniform field, we found that the induction in different positions could be represented by a curve of sines, as in fig. 102. But in actual machines with iron in their armatures this condition is not obtained, since the field is not uniform, its distribution depending on the shape of the iron parts. The curve representing the induction may be therefore very different from a curve of sines, and there are reasons, as we shall see later, for contriving that in machines of *Class 3* at least, it should not be a curve of sines. It might be supposed that in the coils of drum armatures having nearly the whole of the space between the poles filled up with iron, there might be obtained for the induction a closer approximation to the sine curve than in coils wound on armatures of the ring type. But in either type there lies on each side of the point of reversal, as we have called it, a region in which the coil is practically idle; consequently, during a considerable portion of the revolution it contributes no E.M.F. to the circuit. The reason, of course, is, that instead of the whole of the lines of the field being enclosed by the coil at one point only, there is, owing to the presence of the iron core, a considerable proportion of the distance between the polar tips in which the lines enclosed by the coil do not vary. While the coil moves through this region there is therefore no lines subtracted from it and no E.M.F. induced.

It will be seen from the above remarks that by altering the shape of the pole pieces, or armature core, we can produce a considerable variation in the shape of the induction curve, and, obviously, while a coil is furnishing to the circuit no E.M.F. it is wasting power to allow the current generated by neighbouring coils to flow through it. It is, therefore, advantageous from an economical point of view to cut the coils of the armature out of the circuit while they are passing through the region in which they furnish no E.M.F. Referring to fig. 111, we could cut the coils out of circuit for a portion of their revolution by introducing rather wide gaps between the commutator segments instead of the narrow gaps shown. The two commutators with the gaps widened are shown in fig. 112, A, B and C, D being the respective pairs of plates, but a glance at this cut shows at once that it would be impossible with such a couple of commutators to employ the two coils in series, since the circuit would be broken four times in each revolution, and when one of the coils was furnishing a considerable E.M.F. In series the arrangement is therefore unworkable. But if instead of two pairs of brushes connected in series we employ one pair of wide brushes, pressing on both commutators, as at *a* and *b*, fig. 112, we get an arrangement by which each coil is cut out of circuit while idle, and by which the continuity of the circuit is at the same time maintained. In fig. 112 each commutator gap has a width equal to one-eighth of commutator circumference, corresponding to the time during which the coil is idle, whence it follows that the coils are alternately cut out of circuit for one-eighth of a revolution, there intervening between the periods of cutting out, periods of one-

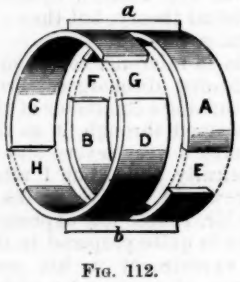

FIG. 112.

FIG. 113

eighth of a revolution, during which the two coils are connected by the brushes in parallel circuit. Dividing a complete revolution of the armature into eight equal periods we have for each coil, first a period during which it is cut out of circuit, then one in which it is parallel with the other coil, afterwards one in which it furnishes by itself the whole E.M.F. followed by one in which it is parallel. Then it is cut out, again parallel, then acting alone, and finally in parallel, the changes being repeated in each succeeding revolution.

The two coils at right angles forming a pair have to be combined in parallel as described if the coils are to be cut out when idle, but we can construct a machine in which there are several such pairs through which

the current flows in succession. The several pairs of brushes for the several pairs of coils are in such a machine connected in series. It is in this way that the Brush dynamo is constructed. On a ring core are wound, each in two diametrically opposite sections, four or six coils, each pair at right angles being connected to a pair of commutators as in fig. 113. The commutator here shown is electrically the same as that shown in fig. 112 but improved mechanically. In fig. 113 the gaps,

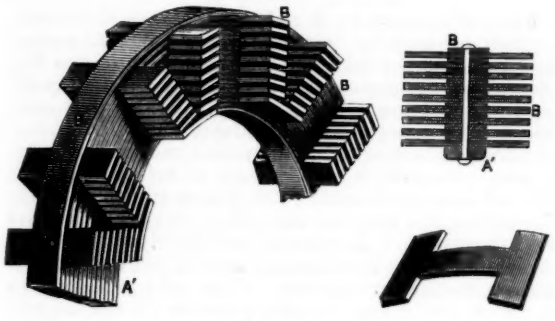

FIG. 114.

E, F, G, H, of fig. 112, are filled up by projections on the adjacent rims of the commutator plates, this ensuring equal wear of the plates and preventing the commutator from getting out of truth. The armature, fig. 114, is constructed by winding on an interior ring, A, a soft wrought iron ribbon, B, there being secured between

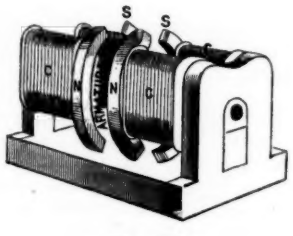

FIG. 115.

the successive convolutions, I pieces of iron of the same thickness as the ribbon. These I pieces have webs equal to the width of the ribbon, the flanges consequently protruding on each side, and forming projections between which the sections are wound. They are held firmly in their places by the radial rivets which bind the armature together passing through

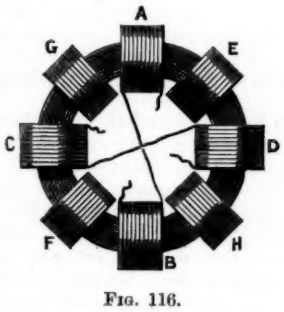

FIG. 116.

them. The field magnets are arranged parallel to the shaft, as in fig. 57 (page 693, Vol. XXIII.), there being two horseshoes presenting to the flat sides of the armature extended pole pieces, as shown at N, S, fig. 115. The facing poles of the two horseshoes are of the same polarity, and the four magnetising coils are designated by the letter C. It is to the peculiar combination of the polar extensions with the projections on the armature that the fact of the coil being idle for one-eighth twice per revolution or for one fourth of the whole revolution is due. Up to those for 25 arc lamps in series the armature has four coils or eight sections, while the armature for the 60-lamp machine has six coils wound in twelve sections. In fig. 116 is shown the four-coil armature, the coils A, B, and C, D, being connected to adjacent commutators and having, as already explained, one pair of brushes between them. The coils E, F, and G, H, are connected to a second pair of adjacent commutators having another pair of collecting brushes. On the 60-light armature there are six coils and three pairs of adjacent commutators. Fig. 117 shows exactly the

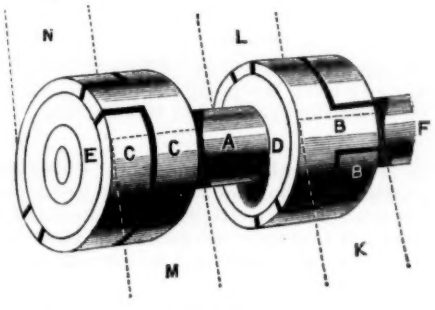

FIG. 117.

arrangement of the commutators for a four-coil armature. Each pair of commutators is mounted on a body, D or E, made of insulating material, this being in turn fastened upon a metal brush, A, which is keyed to the shaft, F. The current passes from brush K through the two coils connected with the two commutators, B, to brush L, thence it is led to brush M, and passes through the two coils connected with C to N. One commutator is 45° in advance of the other, corresponding to the angle between the pairs of coils in parallel. Thus, while one of the coils connected to C is cut out, both coils connected to B are in parallel, and while one of the coils to B is cut out, both coils to C are in parallel. We have, therefore, three coils always in circuit two in parallel under one pair of brushes, one acting alone under the other pair. There is consequently furnished to the circuit by each pair of coils an E.M.F., which is alternately due to two coils in parallel and one coil acting by itself.

(*To be continued.*)

NOTES.

Berlin Electric Light Cables.—A correspondent informs *Industries* that up to the present time the joints between the lead cables which are used in connection with the Berlin central electric light stations were made by special clamps, it having been considered impracticable to make soldered joints between heavy cables; but now one of the engineers of the company has invented a method of soldering even the heaviest cables, whereby injury to the insulating material is avoided, the application of heat being purely local. It is expected that this discovery will have a considerable field of application in various industries.

Electric Light in Zurich.—Six firms have tendered for the electric lighting of Zurich, according to the *Centralblatt für Elektrotechnik*. They are Messrs. Siemens and Halske, of Berlin; Crompton and Company, Limited, of Chelmsford; the Thomson-Houston Company, of Hamburg; L. and J. Sée, of Lille; Ganz and Co., of Buda-Pesth; and Schuckert, of Nuremburg.

Birmingham Electric Lighting Provisional Order.—Petitions praying to be heard against this Order have been deposited in the Private Bill Office of the House of Commons by the Great Western Railway Company and the London and North-Western Railway Company.

The Electric Light in Chicago.—There has just been finished in Chicago an important central electric lighting station, the capacity of which is not less than 80,000 lamps ; 13,000 are already at work. The distribution, which is made on the Edison system, has a length of subterranean conductors of about 20 miles. The works will contain 36 Edison dynamos of 600 ampères, eight of which are already installed. Besides electricity, the station will furnish motor power, similar to the manner in which all American enterprises of this nature do. A large number of applications have been received for this service, among which the most varied uses for it figure—printing machines, lifts, ventilators, pumps, &c.

Electric Lighting in China.—Chinese journals state that electric lighting is rapidly extending in such towns as Pekin, Hong-Kong, Shanghai and Canton.

The Electric Light in Tasmanian Churches.—St. James's Church of England will be the first church in Tasmania lighted by electricity. The manager of the Mount Bischoff Company has had a line laid from the dynamo that produces the light which illuminates the machinery sheds.

Is Dover to have the Electric Light?—At the meeting of the Dover Town Council on Tuesday the Town Clerk reported that five electric light companies had applied for a provisional order to supply Dover with the electric light. The Deputy Mayor said he believed the council had power to apply for the provisional order themselves, and that their claim would have priority. The Town Clerk said he could not answer as to that. The Act of Parliament required that any company applying to the Board of Trade for a provisional order had to obtain the sanction of the Town Council. He suggested that he should acknowledge receipt of the notices, and asked to be furnished with particulars of the proposals, so that they might be considered by the council, and he might also bring up the exhaustive report made by a special committee in 1882, when the Act was first passed, with reference to the council undertaking it themselves. Alderman Fry said he thought the committee should be revived, so that they could go into the matter. Great advancement had been made since that time. The cost of electricity had been reduced very greatly, and it was becoming as low as gas, and at Folkestone they were going to light the town throughout with the electric light. Alderman Adcock said he agreed with Alderman Fry that they might take the matter into consideration, but he thought they ought to know whether the companies were in earnest or not. There seemed to be a wish to see who should be first in the field for some purpose or other. If there were any experiments to be made he hoped other towns would be allowed to make them—not Dover. Ultimately the Town Clerk was instructed to bring up the report of the 1882 committee, and to apply to the companies in question for particulars of their proposals.

Electric Lighting at Eastbourne.—At a meeting of the Eastbourne Town Council on Tuesday, the Lighting and General Purposes Committee reported that at one of their recent meetings the Town Clerk reported that he had received a notice from the secretary of the Eastbourne Electric Light Company, Limited, of their intention to apply to the Board of Trade for a Provisional Order to authorise the supply of electricity by the said company for public and private purposes within the Borough of Eastbourne, for such period as the Board of Trade may think proper, and in all respects subject to and in accordance with the provisions of the Electric Lighting Acts. It was thereupon resolved : "That it be an instruction to the Town Clerk to obtain a copy of the proposed application, when made, for the consideration of the Council." The clause was agreed to by the Council without discussion.

Electric Light in Belgium.—The Société Industrielle d'Electricité, of Brussels, is in liquidation, and a new company is to be formed by the managers of the old one.

The Brussels Municipality has received a large number of offers for the electric lighting of the town, those from America being very low. No decision has yet been taken.

The Société Belge d'Electricité has received orders for electric lighting in Florence and Pistori, Italy.

Electric Lighting for Manchester.—At the Manchester Council meeting on Wednesday, July 3rd, Alderman Lamb moved the adoption of the report of the Gas Committee. Alderman Sir John Harwood, in seconding the resolution, desired to intimate that the committee were going to ask the Mayor to call a special meeting of the Council at their next meeting, in order to pass a resolution with regard to electric lighting. He had been investigating this matter on behalf of the committee, and they had gleaned a considerable amount of information. He would not anticipate what the companies might be doing, because he did not wish to embarrass them in any way. They were in good time, and were taking care that the interests of the citizens are not being neglected, and next Monday they would be enabled to unfold their scheme, and ask the Council to endorse it. The resolution which would be submitted would be asking for authority to apply to the Board of Trade for a Provisional Order authorising the Corporation to introduce electric lighting into the city.

Telephony in France.—Official sanction has been given to the formation of a telephonic system for the town of Grenoble, Isére.

Telephony in Austria-Hungary.—Telephonic connection between Vienna and Prague will be completed by the end of August.

Telephonic Extension in the West.—The Western Counties and South Wales Telephone Company are steadily continuing their policy of extension. At Plymouth, Plympton, Ivybridge, Totnes, Paignton, Dartmouth, Brixham, and Newton conversation by telephone is not limited to subscribers, but the general public can participate temporarily in the benefits of the exchange by payment of a fee varying from 4d. to 9d. It is hoped that before long Plymouth will be connected with Exeter and Bristol as well as with South Wales and the large Northern and Midland towns. At Plymouth, Torquay, and Paignton the exchanges remain open all night. Owing to the number of professional gentlemen residing at Mutley the exchange there is also open all night. The Devonport Exchange is not open much after business hours, but as soon as its nineteen subscribers are increased to thirty Devonport will be accorded the same privilege. The average daily number of messages passing through the Plymouth Exchange is 1,500, yet it will generally be admitted that telephony is as yet in its infancy in the west.

The Duke of Portland and the Telephone.—It is said the Duke of Portland has had a room in Welbeck Abbey fitted up with telephone instruments and switchboard, by which communication can be had with the duke's private room, the kennels, Cuckney House, the estate offices at Mansfield, Woad House and the home of Mr. Warner Turner, the duke's private secretary. The Duke of Newcastle's agent, Mr. Joel Haslam, is having his estate office at Worksop connected with the National Telephone Company's system.

Suburban Lighting.—Mr. H. C. Parsons, electrical engineer to the firm of R. H. Hughes, Hatton Garden, has received the order to install the electric light at the suburban residence (Horner Grange) of W. Knight, Esq. About 150 16-C.P. lamps will be used to light the Grange and stables, the generating plant consisting of Crossley's engine and Elwell-Parker dynamo, with a 75-light battery of Drake and Gorham's accumulators.

Transmission of Power.—In the printing works of Herr R. Winckelmann, Berlin, the whole of the machines are driven by electro-motors, supplied with current from the neighbouring works of the Allgemeine Elektricitäts Gesellschaft. The motors only take a fraction of the space which would be occupied by a steam engine and boiler of moderate power. The installation has been carried out by Dr. Salzmann.

The Paris Exhibition.—It is only a few days back since the whole of the electrical exhibitors have been quite ready, and had all the dynamos, accumulators, lamps, &c., in place, but some of them have got the exhibits carefully shut up in glass cases so that it is impossible to examine them. M. Vigreux, who is known by his studies on the subject of the electric transmission of power, is going to install ventilating apparatus in the Machinery Hall, where it is much required. The Pavilion of the Société Generale des Téléphones is now open to the public, and each evening there can be heard performances at the Opera and several theatres.

Proposed Submarine Cable.—The Chilian Government, considering it indispensable that telegraphic communication should be established between Panto-Arenas (Sandy Point) and the centre of the Republic, in order to facilitate the navigation of the Straits of Magellan and the south coast, as well as to assist in the development of the new towns of Palena and Munoz-Gamero, ask for tenders for laying a cable to connect Melipulli and Paenta-Arenas, and touching at Quincavi, Palena, Melinka, Port Otway, and Munoz-Gamero. Firms tendering are to state the dimensions of the cable they intend to employ, and the price is to include the necessary instruments in each office. Tenders are to be handed in by 30th November next to the Minister of the Interior, Santiago. In the event of any tenders being for the same sum, preference will be given (*a*) to the firm offering the best material, (*b*) the shortest delay in laying the cable, and (*c*) the best guarantee for the execution of the contract. The firm whose offer is accepted will be responsible for the good working of the cable for one year, dating from the termination of the work and the provisional acceptance of the work. At the expiration of this period the definite acceptance will be made, and the caution money refunded. Tenders are to be accompanied by the sum of 5,000 piastres.

Telegraphy in Brazil.—The Brazilian Government will receive, until 30th October next, offers for the establishment of telegraph communication by means of one or several cables between Brazil and the United States of America.

Telegraphy. — According to the *Journal Télégraphique*, of Berne, the number of telegraph stations in the world was increased last year by 7,200.

Central Station at Montluçon.—A central station has recently been established in this town for the supply of 600 16-C.P. lamps. Motive power is supplied by a horizontal engine of 60 H.P. made by Messrs. Buffaud and Robatel, of Lyons. There are two shunt Edison dynamos of 180 ampères and 105 volts running at 950 revolutions. There are three distributing circuits connecting the station with places 500 to 600 metres distant.

Chronometrical Congress. — Several electrical subjects will be dealt with at this congress which is to be held at Paris Observatory on 7th September next, including the electrical transmission of time, registering instruments and magnetic influences upon chronometers.

Journalistic Change.—From the 1st inst. the *Centralblatt für Elektrotechnik* will appear weekly in an enlarged form.

Conferences at the Paris Exhibition.—There have been arranged by the Société International des Electriciens a series of combined conferences and visits to various sections of electrical engineering at the Exhibition. The first was to be held yesterday, with a discourse by M. Napoli, on "Instruments of Precision;" the following have also been arranged:—9th July, M. Sarcia, on "Electric Accumulators;" 11th July, M. Seligmann-Lui, on "Telegraphy;" 18th July, M. Hospitalier, on "Electrical Measuring Instruments;" 23rd July, Capt. de Place, on "Electricity in Connection with War;" 25th July, M. Dumont, on "Railway Appliances;" 30th July, M. Hillairet, on "Motors and Transmission of Power;" 1st August, M. de la Touanne, on "Telephony;" 6th August, M. Arnoux, on "Continuous Current Dynamos;" 8th August, M. Lemonnier, on "Applications of Electric Lighting to the Army and Navy;" and 13th August, M. Picou, on "Alternate Current Dynamos and Transformers."

Electropathic Quackery.—In quoting our recent approving comments on the action of the *Evening News and Post* in connection with the performance given at St. James's Hall by a "medical electrician," that journal makes a further attack upon bogus practitioners, and suggests, as we have done over and over again, that the authorities should do something in such matters. Our contemporary says: "The well-to-do, who can afford to drop a fiver or two without inconvenience, are not duped in these sort of cases. It is the poor whose hard-earned money is transferred to the pockets of unscrupulous adventurers." It is satisfactory to note that the question has thus been now taken in hand by a daily, for that section of the Press has hitherto been silent on the subject.

The Barking Road Electric Tramway.—The first of the Electric Traction Company's cars, having been duly licenced by the Police authorities and the Board of Trade, commenced running on the Barking Road section of the North Metropolitan Tramway Company on the 14th ult. A second car was put on the following day, and the six cars, which will shortly entirely supersede horses, will be placed in active work as soon as the drivers become accustomed to the new form of traction. These cars carry 52 passengers, and do 17 journeys daily with one change of accumulators.

The Electric Light in Warfare.—Some interesting experiments, which tended to clearly establish the utility of the electric light in warfare, took place in the Solent last week. As a better means of defending the roadstead an electric search light has recently been erected on the Spit, near Hurst Castle, opposite the Needle's passage, and six gunboats, with several torpedo craft, tried the other evening to effect an entrance from the westward without being perceived. The attempt was a failure, as each vessel was spotted by the powerful light when miles off, and the guns were all ready when they came within range. To make matters worse for the attacking flotilla the smoke which they created in profusion, so as to prevent the ships from being seen, was blown astern by the wind, and the result was a complete victory for the electric light.

The Edinburgh Exhibition.—An application has been made to the Corporation of Edinburgh for the use of the East Meadows as the most convenient site for the proposed Electrical Exhibition to be held next year. The International Exhibition of 1886 was erected on the West Meadows.

An Electrical Tramway to Morecambe.—In a Committee of the House of Commons sanction has been given to a Provisional Order of the Board of Trade for the construction of a tramway to be worked by electrical power, from Scotforth, *viâ* Lancaster, to Morecambe. There was no opposition except on the part of the County Council, who objected to the character of the line over Skerton Bridge, and terms were arranged to their satisfaction.

Firemen and Electric Bells.—Arrangements are in progress with a view of providing electric bells at the residences of 12 members of the Leicester fire brigade. The necessary wires are now being laid down and the apparatus will be in working order in a few days. The electric bells will be in direct communication with the fire station, and thus much valuable time will be saved in the event of an outbreak of fire.

Gas Batteries.—Mr. Treeby, in a letter to *Engineering*, says: "I notice in your last issue of the 21st, you mention a gas battery constructed by Mr. Ludwig Mond and Dr. Carl Langer,* which evidently is practically the same as some devised and described by me in the *English Mechanic*, Nos. 1,245, 1,246, 1,249, 1,252, 1,253 1,255, 1,257 of this year's issue, and as I have reason to believe that I am entitled to the credit of being the first to introduce either pierced or wire mesh plates covered with platinum black, and also the method of passing air over or through the battery in order to evaporate the surplus water, and by generating ozone in the plate to raise the electromotive force of the cell, I should feel obliged if you will publish this. For nearly four years I have given this subject my exclusive attention, and the above methods have been known and practised by me for the last two years, as my letters to the *English Mechanic* will show."

Birmingham Electric Exhibition.—It is now stated that Mr. Edison has definitely promised to pay Birmingham a visit on his way to or from Paris.

Fluctuations of Electric Shares.—We hear the shares of the Electric Glow Lamp Company (Seel patent) of Berlin, have lately undergone strange fluctuations in the market. In February they stood at 150, and shortly afterwards they went up to 190. A short time ago they sold at 110, though a few have since obtained 118½. No definite reasons can be assigned, but rumours respecting difficulties about the patent are abroad.

A New Automatic Reading Lamp.—The latest of the applications of what is known as the coin-freed automatic apparatus is the adaptation of this principle to the supply of electric light in the shape of reading lamps for railway carriages, omnibuses, tramcars, &c. The lamp in question has been patented by a Leeds firm. The lamp, as originally patented, consists of a clockwork apparatus contained in a box 5 inches by 5 inches by 3 inches, and by introducing a penny into the top of the machine, and subsequently pressing a knob, the mechanism is set in motion and an electric light obtained, which, after burning for half an hour, is automatically extinguished. The lamp can, moreover, be extinguished at will by pressing a second knob. This lamp will, in the course of a few days, be in use on the Great Western Railway. The source of power generating the light is an accumulator, which, placed in any of the compartments of a carriage, will supply with electricity the whole of the lamps in the carriage. The accumulators will be charged with a 40 hours' supply.

London Chamber of Commerce.—Referring to our report of the meeting of the Electrical Trades' Section last week, we are requested to mention that the screw thread referred to was the British Association thread; also that the statement that Mr. Trotter gives the whole of his time to the duties of correspondent is rather misleading, as it implies that he has no other business.

Electric Cranes.—There is employed in the wool stores at Roubaix, France, a movable electric crane which lifts a weight of 10 cwt. a height of 26 feet in 25 seconds. The crane does not run on rails but on the floor, so that it may be more freely manœuvred, and by its use a great saving in time and labour has been effected. The current is supplied from conductors along the ceiling, which are connected by wires to the upper part of the standard of the crane.

* See ELECTRICAL REVIEW for last week.

The Society of Arts.—The Society of Arts held its annual conversazione at the South Kensington Museum on Friday, the 28th ult. The company should have been received in the West Architectural Court by the Duke of Abercorn, C.B., chairman of the Council, but in his absence, through indisposition, the duty was performed by Sir Frederick Bramwell and Sir Philip Cunliffe Owen. The greater proportion of the museum was open to the visitors, who were enabled to stroll throughout the whole of the courts and corridors on the ground floor, and the galleries containing the Raphael cartoons, the Sheepshank collection, the Smith collection of water colour drawings, the Dyce and Forster pictures, and the Chantrey bequests. In addition to these attractions a band stand had been erected in the central quadrangle, where the band of the Scots Guards, at intervals, played through a somewhat lengthy but diversified programme of music. The night, though starless, being warm and fine, hundreds of people were drawn to the quadrangle by the double attraction of the music and the pleasure of promenading in the open air. The band of the Royal Artillery also played a selection of music in the North Court, in the course of which Sergeant Jenner rendered the lovely "Adieu" of Schubert as a cornet solo. As further entertainment for their guests, the Society had engaged Mr. Edward Plater's Glee Union, represented by Mr. Jas. Brown, Mr. Albert James, Mr. Edward Plater, and Mr. Frederick Bevan, who gave three separate performances during the evening of glees and part songs, and we were especially taken with Mackenzie's "Little Byngo," and by their tender and effective rendering of that most exquisite and perfect of all glees—"By Celia's Arbour." By means of these several centres of attraction the company present, numerous as it was, was effectually dispersed, so that at no time during the conversazione was there any unpleasant crowding, and this absence of crushing tended in no little degree to enhance the enjoyment of all.

Telegraphy in San Salvador.—There are 93 telegraph stations open in the Republic of San Salvador. The mileage of wire is 1,443, and the estimated net profit last year was £1,338.

The Use of Electricity in Philadelphia.—There are 1,300 buildings in this city furnished with electricity for light or power purposes, and on not one of these has there been any loss by fire for two years past.

Electricity and the Forthcoming Railway Congress.—At the third Railway Congress, which is to be opened at Paris in September next, Class XI. is devoted to the application of electricity. The full heading of the class is as under:—To study the most recent application of electricity in the working of railways, particularly as regards—A. The lighting of trains and stations; B. The braking of trains; C. The soldering and brazing of metals, notably for the repair of rolling stock.

The Mining Congress at Paris.—This congress will commence on September 2nd, and among the subjects upon which papers are to be read are, safety lamps and the application of electricity to underground workings, for drawing, lighting, signalling, and for transmission of power.

Transmission of Power in Mines.—An American journal describes the arrangement of a winding plant, situated on the surface of a mine, and hoisting from an underground slope. A bore hole, 4 inches in diameter, was sunk 600 feet deep. An engine and boiler have been placed in position on the surface close to the bore-hole. Power is then transmitted by means of a wire rope, and an arrangement of pulleys at the top and bottom of the bore-hole. The engineer is rather proud of this job; but it appears as if the whole object could have been achieved more economically and simply by electrical transmission of power. Seeing the large development of electrical engineering in the United States, it is surprising to see any engineer adopting the foregoing clumsy arrangement.

Progress of Electrical Railways in Boston.—*Modern Light and Heat* says: "At the rate work is progressing on the electrical equipment of city and suburban railways in and about Boston, the day is not far distant when a trip of twenty-one miles on electric cars will be a *fait accompli*. From Arlington on one side to Hingham on the other the distance is twenty-one miles, and a considerable portion of that distance is already equipped and cars running on schedule time. Boston will lead the way still in its street car service."

A Curious Grievance.—It is said a Maine man is bringing an action against an electric company for damages because the company's arcs keep his hens awake until midnight. On this account he says: "The hens, being worn out for want of sleep, are too tired to lay."

Provisional Orders for Chatham.—At a meeting of the Chatham Local Board of Health on Friday morning a notification was received from the Chatham and Rochester Electric Lighting Company that the Board of Trade was empowered under a recent Act to exercise certain jurisdiction over companies having no Provisional Order, and they (the Board of Trade) required the companies to put the wires underground. In order to obtain the necessary powers to place the wires underground, the company had decided to apply for a Provisional Order which would give them power to break up the public streets in Chatham and other places. The clerk reported that it was necessary for plans to be before the Board before they could give consent to the Provisional Order. Mr. Taylor said that other Boards had given their consent without having plans. Mr. Randall said that was because the other Boards had not the experience of the Chatham Board. Mr. Church, as a user of the electric light, said if they waited for plans they might have to wait years, as the company could not tell where the wires would have to go. The Clerk said the Board of Trade would require plans. Mr. Taylor said he should propose that consent be given. To refuse consent would be standing in the way of public improvements. Mr. Church said he should second it. Mr. Randall said they must have the plans. Mr. Taylor asked, as the company could not tell, who was going to have the electric light, how they could produce plans as to where the wires were going. Mr. Randall said they had a professional gentleman as clerk, and he had given his advice that they must wait until they received the plans. The Clerk said he was solicitor to the company as well as Clerk to the Board, and he was bound to give the advice he had given. The proposition was then withdrawn, and on the motion of Mr. Randall, seconded by Mr. Buch, it was resolved to have a copy of the proposed Provisional Order before discussing the matter further.

The Shah's Visit.—Messrs. W. Mackie and Chalmers lighted up with incandescent lamps the ss. *Duke of Edinburgh*, which vessel received the Shah at Gravesend.

Saving Life at Sea.—The Eastern Telegraph Company recently invited a party of gentlemen, interested in the subject of lowering boats at sea, to attend a practical demonstration of the efficiency of Mill's patent disengaging hooks as fitted to the boats of the steamship *Mirror*, the steamship *Electra*, and three others of the Telegraph Company's fleet. The trial took place in the West India Docks, and was attended by nearly 20 gentlemen, the party being conveyed from the Temple Pier to the West India Dock Pier in Messrs. Immisch and Co.'s electric launch the *Viscountess Bury*. Had this demonstration been made above bridge instead of below, who knows but what the party would have shared the same fate as that on board the *Volta*?

Electric Lighting Installation in Brussels.—The workmen of the technical services of the city of Brussels have just placed the electric cable destined to join the Théâtre de la Monnaie and the House of the King, into the cellars of which has been transferred the old battery of 200 accumulators which served for the lighting of the footlights, and the appointments of the stage. This battery was judged insufficient, and has been replaced at the theatre by a new one of 600 accumulators of more restricted dimensions. The laying down of the cable was done as follows:—At the bottom of a trench was disposed a layer of creosoted joists on which was spread a bed of clay, 10 centimètres in thickness. The sheathed cable lies on this bed of clay; a second layer of clay of the same thickness covers it in order to protect it from the infiltration of corrosive liquids. Some union tiles are laid above the clay which they protect against the blows of the pavior's pickaxe. The work of laying down this cable has been completed in the Rue Léopold, Rue de l'Eauyer, Rue des Dominicains, Petite Rue des Bouchers and Rue Chair et Pain.

The Utilisation of Electricity at Shooting Ranges.—At the new Brussels shooting ranges, to be opened on Sunday next, electricity has been pressed into service. Among the new installations is that of an electrical marking apparatus which will cause the disappearance of the disputes brought about by the old system of recording the result of shots. The apparatus is composed of two boxes united by wires, placed, one in the shooter's box, the other in the trench where the marker shelters himself. The first of these boxes is ornamented with a figured dial provided with a movable needle; the second box also has a dial, of which each figure surmounts a hole intended to receive the copper pin which establishes the electrical contact. The shooter makes 3, we will say for example, the marker introduces the pin into the opening under the figure 3 on his dial. As soon as the contact is established the needle of the dial by the shooter's side begins to move and then stops at the figure 3. As will be seen it is simple and practical.

Société Electrique Vevey-Montreux.—This Swiss Company supplies light and power within a distance of 5 miles from the central stations. The Vevey and Montreux systems are independent, the main cables being respectively 5½ and 4 miles in length. Alternate currents are almost exclusively employed, and transformers distribute it at a tension of 100 volts at the price of ·7d. per ampère-hour. The number of lamps was originally 573, but at the close of last year numbered 3,162, an increase of 2,589. The cost of lighting was 31,050 frs. 55 cents. and the receipts were 32,571 frs. 15 cents, a profit of 1,520 frs. 60 cents, or say about £61. The same company works an electric tramway, 10,370 kilometres in length. The number of passengers carried in the last seven months of last year was 320,412. The expenses were 49,822 frs. 65 cents, and the receipts 66,978 frs. 60 cents, showing a profit of 17,155 frs. 95 cents, or say about £686.

Robbery by Telephone.—As a pendant to insult by telephone, we now have robbery by means of the same apparatus, also in Paris. Two confederates, young men from 23 to 26 years of age, named Dufour and Saussuse, who live by their wits, have made the telephone an accomplice in duping various Paris merchants. Their procedure was as follows:—Dufour entered a telephone cabin and asked for communications with the commercial house selected. "Sir," he said, "I have to ask you on the part of —— (here a name well known on the Paris market was always inserted), if you have a remnant of silk of such a quality. We want it at once, and will send a clerk for it." If the answer was affirmative, Saussuse presented himself a quarter of an hour later, when the remnant was given him, and the trick was done. The two gentlemen, however, became too confident, and were captured, and are now awaiting their trial.

NEW COMPANIES REGISTERED.

Series and General Electric Traction Company, Limited.—Capital, £200,000 in £1 shares. Objects: To acquire the patents, property, goodwill, business, undertaking and assets of the Series Electrical Traction Syndicate, Limited, or any part thereof, and certain patents, or rights, or interests, belonging to Messrs. Henry Foote and Carl von Buch. To make and supply electricity, and to carry on business as tramway and omnibus proprietors, and carriers of passengers and goods. To apply electricity for lighting, heating, signalling, telephonic, motive or brake purposes. Signatories: * The Hon. A. E. Gathorne Hardy, M.P., 22, Charles Street, Berkeley Square; * Lieut.-Col. C. M. Davidson, 11, St. George's Square, S.W.; * Lieut.-Col. E. J. Fryer, 22, Ryder Street; 300 shares each. T. R. Greenhill, 11, Brownswood Park, N.; W. A. Morton, 111, Foulden Road, N.; E. F. Lamb, 14, Victoria Street, N.E.; J. P. Scott, Lee; 1 share each. The signatories denoted by an asterisk, and J. W. Maclure, Esq., M.P., the Earl of Crawford, the Hon. Regd. Brougham, Carl von Buch, Esq., and Henry Foote, Esq., are the first directors. Qualification, 300 shares. Remuneration: £500 per annum for the chairman, and £250 per annum for each other director. Registered 25th ult. by Norton, Rose & Co., of 10, Victoria Street, Westminster, and 57½, Old Broad Street.

Northern Electric Wire and Cable Manufacturing Company, Limited.—Capital, £20,000 in £5 shares. Objects: To carry on business as insulated wire and cable manufacturers, and for such purposes to carry out an agreement of 20th June between Blakey, Emmott and Company, Limited, and James Duff (trustee for this company). Signatories (with 1 share each): W. Emmott (electrician), Walter Levi, W. Shaw Smith, W. Gantinger, all of Halifax; E. H. Fowle, Lapley, Stafford; E. Blakey, Lightcliffe (electrical engineer); G. Rhodes, Sowerby Bridge. The signatories are to appoint the first directors. Remuneration: A director residing within 90 miles of the place of meeting will be entitled to £2 2s. for every meeting attended, and if residing more than 90 miles to £4 4s. A further sum of £20 in respect of each 1 per cent. dividend upon the ordinary shares beyond 10 per cent. per annum will be paid to each director, provided that such further sum shall not exceed in the aggregate £1,000 per annum. Messrs. Edwin Blakey and Walter Emmott are appointed managing directors at a joint remuneration of £300 per annum, together with the same percentage payable to the ordinary directors. Registered 26th ult. by Godfrey Rhodes, Firth & Co., 77, Chancery Lane. Registered office, Square Road, Halifax.

Birmingham House-to-House Electricity Company, Limited.—Capital £100,000 in £5 shares, 100 of which are founders' shares, entitled to one half of the surplus profits of each year after payment of a non-cumulative dividend of £7 per cent. per annum upon the ordinary shares. Objects: To form centres in Birmingham, or elsewhere in the United Kingdom, for the generation, accumulation, and distribution of electricity for public and private lighting, motive power, heating, electro-plating, electro-deposition, for telephonic or other purposes. To acquire the right to manufacture and put up telephones, telegraphs, electric bells, phonographs, and other electric apparatus. To train and supply consulting electricians, engineers, and skilled workmen. To manufacture and deal in glass, India-rubber, vulcanite, iron, copper or other metals, electric conductors or non-conductors. To carry on the business of wire drawers, wire insulators or coverers. To construct railways, tramways or water-ways, and to apply to the same any method of electric locomotion, electric-motive power, or otherwise. Signatories (with 1 share each): Robt. Hammond, 117, Bishopsgate Street (electrical engineer); C. Cornish, 132, Belvedere Road, Lambeth; J. Whitehead, Heycot, Crouch End (electrical engineer); Thos. E. Towerson, F.C.S., 1, Portland Road, Finsbury Park: W. G. Bingham, C.E., 7, Bedford Place, W.C.; H. Linklater, 117, Bishopsgate Street; and H. Mann, 12, Woburn Place, W.C. The signatories are to appoint the first directors, and are to act *ad interim*; qualification, £250 of share capital; remuneration, £500 per annum, together with one-tenth of the net profits remaining after payment of 7 per cent. upon the ordinary shares, provided that the total remuneration shall not exceed £1,000 per annum. The holders of the founders' shares will be entitled to elect a director, and the House-to-House Electric Supply Company, Limited, will also be entitled to representation at the board. Registered 26th ult. by Slaughter and May, 18, Austin Friars.

Irish House-to-House Electricity Company, Limited.—Capital £100,000, in £5 shares. Objects: To form centres in Ireland or elsewhere in the United Kingdom at which electric power may be generated, accumulated, or distributed. The signatories are the same as in the preceding company, and the same regulations as to management and founders' shares also apply. Registered 26th ult. by Slaughter and May, 18, Austin Friars.

Lancashire and Cheshire House-to-House Electricity Company, Limited.—Capital £100,000, in £5 shares. Objects: To form centres in Lancashire and Cheshire, at which electric power may be generated, accumulated, and distributed. The signatories and regulations for management, and for founders' shares, are the same as in the two preceding companies. Registered 26th ult. by Slaughter and May, 18, Austin Friars.

Liverpool House-to-House Electricity Company, Limited.—Capital, £100,000 in £5 shares. Objects: To form centres in Liverpool or elsewhere for the generation, accumulation, and distribution of electricity. The arrangements regarding founders' shares and for management, are the same as in the three preceding companies. Registered 26th ult. by Slaughter and May, 18, Austin Friars.

Manchester House-to-House Electricity Company, Limited.—Capital, £100,000 in £5 shares. Objects: To form centres in Manchester for generating, accumulating, and distributing electricity. The same regulations as to founders' shares and management as in the four preceding companies apply. The signatories are also the same. Registered 26th ult. by Slaughter and May, 18, Austin Friars.

Midland House-to-House Electricity Company, Limited.—£100,000 in £5 shares. Objects:—To form centres in the Midland Counties for the generation, accumulation, and distribution of electricity. The signatories and management arrangement are the same as in the five preceding companies. Registered 26th ult. by Slaughter and May, 18, Austin Friars.

Scottish House-to-House Electricity Company, Limited.—£100,000 in £5 shares. To form centres in Scotland at which electric power may be generated, accumulated, and distributed. The signatories and management arrangements are the same as in the six preceding companies. Registered 26th ult. by Slaughter and May, 18, Austin Friars.

South of England House-to-House Electricity Company, Limited.—Capital, £100,000 in £5 shares. Objects: To form centres in South of England for generating, accumulating, and distributing electricity. The signatories and arrangements are the same as in the seven preceding companies. Registered 26th ult. by Slaughter & May, 18, Austin Friars.

Yorkshire House-to-House Electricity Company, Limited.—Capital, £100,000 in £5 shares. Objects: To form centres in Yorkshire for generating, storing, and distributing electricity. The signatories and regulations for management are the same as in the eight preceding companies. Registered 26th ult. by Slaughter and May, 18, Austin Friars.

Northern House-to-House Electricity Company, Limited.—Capital, £100,000 in £5 shares. Objects: To form centres in the Northern Counties for generating, storing, and distributing electricity. The management

and regulations are the same as in the nine preceding companies. The signatories are also the same, with the exception of W. G. Bingham, C.E., instead of whom P. A. Latham, of 15, St. Helen's Place, E.C., is substituted. Registered 26th ult. by Slaughter & May, 18, Austin Friars.

Western House-to-House Electricity Company, Limited.—Capital, £100,000 in £5 shares. Objects: To form centres in the Western Counties for the generation, accumulation and distribution of electricity. The signatories are the same as in the preceding company, and the regulations for the management are the same as in the ten preceding companies. Registered 26th ult. by Slaughter & May, 18, Austin Friars, E.C.

Cambridge University and Town Electric Lighting Company, Limited.—Capital £50,000, in £5 shares. Objects: To carry on at Cambridge and elsewhere the business of an electric light company in all its branches. Signatories (with 1 share each): F. C. Ware, Mayor of Cambridge; C. Geldard, M.A., C. Armstrong, J. N. Pryor, E. Barrett, W. M. Fawcett, M.A., Arthur Barrett (electrical engineer), all of Cambridge. The signatories are to appoint the first directors; qualification, £250 in shares; the company in general meeting will decide remuneration. Registered 28th ult. by Walter T. Bowman, 2, Earl Street, Cambridge.

South-Western District and Thames Valley Electricity Supply Company, Limited.—Capital £100,000, in £10 shares. Objects: To erect station for creating and storing electricity for supplying the parishes and districts of Wandsworth, Putney (including Roehampton), Barnes, Mortlake, Kew, Richmond, Petersham, Ham, Kingston, Norbiton, Surbiton, New Malden, Coombe, Wimbledon, and other places in the counties of Surrey, Middlesex, Berks, or Bucks. Signatories (with 1 share each): D. de Castro, 6, New Square, Lincoln's Inn; C. Hood, 53, Balcorne Street, N.E.; F. A. Williams, 4, Shirlock Road; G. A. Best, Little Ilford; L. B. Maskell, 38, Manor Place, Hackney; G. B. Leech, Upper Tooting; G. Duggan, Plumstead. The signatories are to nominate the first directors; the company in general meeting will determine remuneration. Registered 28th ult. by Trinders & Co., 47, Cornhill.

Croydon Electric Supply Company, Limited. — Capital, £5,000 in £5 shares. Objects: To carry on at Croydon or elsewhere the business of electricians, mechanical engineers, and suppliers of electricity. Signatories (with 1 share each): F. H. Rocke, Norbury Park, Streatham; G. Hardy, Holly Park, Crouch Hill; W. Gilbert, 61, Cheapside; J. B. Verity (electrical engineer), 31, King Street, Covent Garden; J. E. H. Gordon, 23, Collingham Place, S.W.; Major J. T. Wright, R.E., 16, Carlisle Mansions; A. O. Miles, 28, King Street, Cheapside. Registered 28th ult., without articles of association, by Saxelby and Faulkner, 7 and 8, Ironmonger Lane, E.C.

Chili Telephone Company, Limited. — Capital, £250,000 in £5 shares. Objects: To enter into an agreement with Wm. Arthur Pittman, and to construct and work lines of telegraph, telephones, or other means of communication with Chili and the adjoining countries, and generally to carry on the business of a telephone, telegraph, and electric light, heat and power supply company. Signatories (with 1 share each): W. Capel Slaughter, 18, Austin Friars; W. A. Pittman, 7, St. Helen's Gardens, North Kensington; H. Mann, 12, Woburn Place; T. Bolter, 31, Ampton Street, W.C.; E. Griggs, Bromley, Kent; J. R. Carter, 2, Steele's Road, Haverstock Hill; H. Livesey Cole, 14, King's Arms Yard, E.C. The signatories are to nominate the first directors; qualification, £1,000 in shares; the company in general meeting will determine remuneration. Registered 28th ult. by Slaughter and May, 18, Austin Friars.

Devon and Cornwall Electricity Supply Company, Limited.—Capital £100,000 in £5 shares, 100 being founders' shares. Objects: To establish centres in Devon and Cornwall for the generation, storage and distribution of electricity for all purposes. Signatories (with one share each): W. T. Spearman, Coryndon Matthews, J. Walling, Hy. Matthews, C. H. Radford, C. C. Boolds, J. May Grose, all of Plymouth; S. Graves, Devonport; Robt. Hammond (electrical engineer), 117, Bishopsgate Street. The signatories are to nominate the first directors; qualification, £250 of share capital; remuneration, £500 per annum and, in addition, one-tenth of the surplus profits remaining after payment of 7 per cent. on the ordinary shares, provided that the whole remuneration shall not exceed £1,000 per annum. Registered 28th ult. by Slaughter and May, 18, Austin Friars.

Kingston-upon-Hull Electric Lighting and Supply Company, Limited.—Capital £1,000, in £1 shares. Object: To carry on at Kingston-upon-Hull the business of an electric light company in all branches. Signatories (with 1 share each): J. Daniell, Brough, East Yorkshire; E. J. Hill, 6, Westminster Chambers; V. W. Hill, Llansaint, Herne Hill, S.E.; T. Hayzew, 3, Lanskert Street, Hull; D. P. Birkenshaw, 4, Parliament Street, Hull; G. Bohn, C.E., Hessle; G. J. Stewart, 6, King Street, Hull. Registered 29th ult., without articles of association, by F. B. Moss, of the Outer Temple.

Leicester Electric Light and Power Company, Limited.—Capital £1,000, in £10 shares. Objects: To carry on the business of an electric light and power company in all branches. Signatories (with 1 share each): J. H. Cooper, T. Fielding Johnson, J.P., J. G. F. Richardson, J.P., L. Turner, J. Lorrimer, A. Ross, Wm. Barfoot, J.P., all of Leicester. Registered, without articles of association, 29th ult. by Walter Webb & Co., 23, Queen Victoria Street.

Dutton and Company, Limited.—Capital, £60,000 in £10 shares. Objects: To acquire the business and goodwill of Dutton & Co. To carry on business as mechanical engineers and electricians, manufacturers of railway and other signals, locking, safety, and detecting apparatus and appliances, electrical and other lamps, dynamos, machines, and all other kinds of electrical and magnetic apparatus. Signatories (with 1 share each): *S. T. Dutton, C.E., Marl Bank, Worcester; *S. J. Cockran, Britannia Square, Worcester; Wm. Buck, C.E., 17, Hemstall Road, West Hampstead; *C. A. Scott Murray, J.P., Henley-on-Thames; *R. H. C. Nevile, J.P., Grantham; T. H. Burroughs, 3, Lincoln's Inn Fields; *C. J. Cockran, 12, Whittingstall Road, Munster Park, S.W. The signatories denoted by an asterisk are the first directors; remuneration £50, to be divided as they may determine. Registered 29th ult. by Bircham & Co., 46, Parliament Street, S.W.

Schoth's Electro-Medical Apparatus Company, Limited.—Capital £10,000 in £10 shares, 5,500 of which are 10 per cent. preference shares. Objects: To take over and carry on the business of Gustave Adolph Schoth, of Euston Road, manufacturer of electro-medical, scientific, and surgical instruments. Signatories (with 1 share each): G. A. Schoth, 230, Euston Road, electrician; A. H. S. Daniell, 49, Moorgate Street; G. E. Pullen, 8, Janson Road, Stratford; O. Frederica, Muswell Hill; J. W. Gaze, Oak Hall, East Ham; L. W. Mercier, 76, Finsbury Pavement. Registered 26th ult., without articles of association, by

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Series Electrical Traction Syndicate, Limited.—At an extraordinary meeting of this syndicate, held at 11, Queen Victoria Street, on the 28th May, it was resolved to wind up voluntarily, Mr. Stephen Hy. West, of Tanfield Court, Temple, being appointed liquidator for the purpose. Authority was given to the liquidator to dispose of the business and property of the syndicate to a new company, called the Series and General Electric Traction Company, Limited. The resolution was con-

firmed on June 17th, and was duly registered on June 25th.

Blockley Electric Lighting and Manufacturing Company, Limited.—The annual return of this company, made up to the 22nd ult., was filed on the 28th ult. The nominal capital is £20,000, in £5 shares. 386 shares are taken up, and the full amount has been called and paid thereon, the paid up capital thus being £1,930.

ELECTRIC LIGHTING AT PORTSMOUTH.

AT a meeting of the Portsmouth County Council on Tuesday, the Town Hall Committee reported that they had had the question of the lighting of the interior of the Town Hall under consideration, and their report was now submitted. They recommended that this report should be adopted, and that they should be authorised to incur the expenditure mentioned. In view of the desire frequently expressed by the Council that some of the principal apartments should be lighted by electricity, the sub-committee had resolved to recommend that the library, reading room, the great hall, the principal corridors, the Mayor's apartments, and the reception room should be thus lighted, leaving the other portions to be lit by gas, the mains for which had been already laid all over the building by the contractors. They had had professional advice on the matter, but the report did not quite accord with their view, and they proposed to take further opinion. From all they could learn they were of opinion that the library and reading room, which would be in daily need of light, could be most economically supplied from the engine, which would be constantly in use for warming and ventilating the building. The other portions of the building to be lit by electricity would only be required at intervals, so they were advised it would be more economical and less costly at first to set up a separate installation for that; and to effect this, and to carry out the whole arrangement, they now asked their sanction, promising not to undertake any plan without having first obtained the best advice procurable on the subject. If they were permitted to carry out those views, they felt satisfied they would be enabled to light the building to the satisfaction of all concerned, to do it efficiently and well, and in such a manner as to obtain results in the working of which no wasteful expenditure would be made. They were able, however, from the information now in their possession to calculate that an outlay of about £3,500 would be needed to carry out effectually the entire work of lighting, it being borne in mind that in dealing with electric lighting, whilst great economy might properly be used in the fittings, yet in the installation and the method of generating the light, especial care must be exercised that none but tried electrical engineers and men of known experience should be employed if the result was to be satisfactory.

Sir WM. KING, in moving the adoption of the report, said that there was a general desire that the electric light should be introduced to the new Town Hall. The committee had consulted two people of eminence, but neither of the reports was altogether satisfactory. The mode of distributing the light was not susceptible of further improvement, but the same remark did not apply to the mode of generating it. Consequently it was not proposed at present to recommend any definite scheme, but the reading-room and library should be lighted immediately; the machinery required for producing the light in those apartments would be required to work the heating and ventilating apparatus. There were, however, magnificent apartments and corridors which would have also to be lighted, and the estimate varied from £1,200 to £6,900. Economy was not the only point to be considered, and before they proceeded further they would have to consult the most experienced men in the profession. The Council had entrusted the committee with the expenditure of £100,000 for the building of the Town Hall, and they now asked to be entrusted with the expenditure of £3,500 on the electric light, but nothing would be done until they had carefully watched the developments that were taking place in the machinery for the production of the light.

Mr. DEAN seconded.

Mr. T. SCOTT FOSTER expressed himself strongly in favour of the electric light. It was desirable to lay down the wires now, but it would be soon enough to erect the machinery when they wanted it. In the meantime they could find out which was the most suitable.

Sir WM. KING, in answer to a question, said that if it were found necessary to incur more than £3,500, they would come again to the Council.

The recommendation was then adopted.

THE ELECTRIC LIGHTING PROPOSALS IN LEEDS.

MR. LEE HARDWICK moved, at the meeting of the Town Council on Wednesday, that the Council authorise the lighting by electricity of such portions of the Town Hall and Municipal Buildings mentioned in the report of the Electric Lighting Committee (the substance of which has already been published), at an estimated expenditure of £3,000.

This was seconded by Alderman SPARK.

In the course of some discussion it was pointed out that £3,000 seemed a very large sum, inasmuch as the Fine Art Gallery and the Free Library were already lighted by electricity, and that the Corporation possessed the plant which was required for the more extensive installation contemplated.

Mr. WILLEY said that the actual expenditure might not be more than £2,500, whereupon

Mr. GILSTON observed that it seemed to him that the committee had no very clear idea as to what it was about to do.

Mr. HARDWICK, replying, said that all that was required were the additional lamps and the wires, &c., for the proposed extension.

The resolution was unanimously adopted.

Mr. LEE HARDWICK next moved the following resolution:—"That the council apply to the Board of Trade for a provisional order under the authority of 'Electric Lighting Acts, 1882 and 1888,' authorising the Corporation, as the local authority under the Acts, to provide and supply electricity for public and private lighting purposes within the area referred to in the report, at an estimated total capital expenditure of £68,000, and that the Town Clerk, in conjunction with the electric lighting committee, be authorised and empowered to take all necessary legal and other proceedings, and to give notices on behalf of the council, which may be necessary in connection with the application to the board for and obtaining such provisional order." He explained the great advantages which the electric light possessed over gas lighting, and said that lighting by electricity had now reached a stage which warranted them undertaking the step proposed. The question was whether the Corporation was to undertake to supply the electric light, or was to allow companies to come in to do so instead.

Mr. BATTLE moved an amendment to the effect that it was not desirable for the Corporation to supply electricity for public or private lighting purposes, as in the opinion of the Council such supply could be advantageously provided by private enterprise. He pointed to the large amount of money which had been invested in electric lighting, and which had been practically lost. He could not, in fact, understand intelligent business men undertaking such a scheme for a moment.

After considerable discussion the amendment was lost, whereupon Mr. KETTLEWELL moved another to the effect that the question be referred back to the committee to report further, especially as to the annual cost of the present installation, and as to the cost in other towns where the electric light had been adopted.

This having been seconded, was adopted.

CITY NOTES, REPORTS, MEETINGS, &c.

The Amalgamation of the Telephone Companies.

MEETINGS OF THE UNITED TELEPHONE AND NATIONAL TELEPHONE COMPANIES.

EXTRAORDINARY meetings were held yesterday at Cannon Street Hotel. The proceedings were of a purely formal character, and were for the purpose of confirming resolutions passed at the ordinary meetings, full reports of which appeared in a former issue.

Mr. James Brand presided at the meeting of the United Company, and briefly referred to the letters written by the Postmaster-General to the secretary, and which had appeared in the *Times*. The directors felt they had the best of the correspondence. They thought it better to leave the matter entirely to the judgment of the public as to whether the telephone companies were doing what they had a perfect right to do, viz., seeking to make themselves stronger—financially and otherwise—and furthermore to enable them to give a better and cheaper service to the public. The resolutions were confirmed.

At the meeting of the National Telephone Company, Colonel R. R. Jackson occupied the chair. After the minutes had been read, the chairman said he was not going into the reasons in favour of the resolutions which would be submitted. They had been amply discussed at the ordinary meeting on June 14th. He would therefore propose the resolutions in succession and ask for their adoption. The resolutions were for the transfer of the properties of the United and the Lancashire and Cheshire Telephone Companies to the National Telephone Company, for the increase of the capital of the company by the sum of £3,250,000, and for the alteration of the articles of association. In order to give effect to the regulations of the company, all the directors holding office prior to their adoption would be removed from office, and the names substituted on the notice before them.

The resolutions were then formally put to the meeting and carried unanimously.

Crompton and Company, Limited.

THE first report of the directors, to be presented at the annual general meeting of the shareholders on Thursday, July 11th, states that the account made up to March 31st last includes a

record of the business done during the period of four months prior to the formation of the company—a period when electrical work generally was not brisk, and when, moreover, the attention of the proprietors was occupied in the negotiations for the formation of the company.

Notwithstanding this drawback, and the fact that the benefit of the increased capital was only beginning to be felt during the financial year comprised in the accounts, it is satisfactory to report that the net profits are in excess of the average of the previous six years, and admit of the payment of dividends both on the preferred and ordinary shares.

After payment of the interim dividend in January last, and providing for vendors' interest and other payments shown in the accounts, there remains a surplus of £5,433 2s. 7d. which the directors propose to dispose of as follows:—1. To carry to a suspense account a sum of £1,500, as a provision for doubtful debts and contingencies. 2. To place a sum of £568 to a reserve fund for equalising future dividends. 3. To declare a dividend of 7 per cent. per annum on the preference shares. 4. To pay the managing directors their fees of £1,000 according to the articles of association. 6. To declare a dividend of 5 per cent. per annum on the ordinary shares.

The sum of £4,594 11s. 6d. has been expended upon enlargement of the works at Chelmsford, and for additions to plant and fixtures. The works are thus rendered much more efficient for economical manufacture, and when the new offices, which are in course of construction, are completed much time and expense will be saved in the management of the business.

Contracts for lighting have been agreed with the Corporations of Folkestone and Chelmsford, and orders for central stations for several provincial towns are practically arranged for. The company is receiving the benefit of the fresh start which has been made in electric lighting, and the works are consequently busy; there appears, therefore, every reason to anticipate that the present year will be a prosperous one.

The business of the company with the Australian Colonies is rapidly increasing, so much so that the company's agents, Messrs. Harrisson and Whiffen, have requested that additional capital may be provided by means of a separate company to which they would themselves largely subscribe. An Australian company has accordingly been registered, and a circular on this subject will shortly be forwarded to the members of this company.

The auditors, Messrs. Duncan Bryce & Co., offer themselves for re-election.

The West African Telegraph Company, Limited.

IN the report presented at the general meeting the gross receipts, including the balance brought down from last account (£1,215 9s. 11d.), amount to £56,530 12s. 11d., the general expenditure being £20,016 0s. 7d. There remains a balance of £36,514 12s. 4d., which has been applied by the directors in the following manner:—After providing for debenture interest £15,000 paid and accrued, £5,000 has been carried to repairs and renewal account, and it has also been considered advisable to write down the preliminary expenses by £259 2s. 8d. These deductions leave an available balance of £16,255 9s. 8d., from which the directors propose to carry £5,600 to the debenture redemption account, and recommend the payment of a dividend for the year 1888 of 5s. per share, free of income tax, absorbing £5,777 5s., leaving £4,878 4s. 8d. to be carried forward to the next year's account.

The company's cables are in good working order, the Bolama-Bissao cable referred to in the last report having been repaired. Since the last report, this company has laid a cable (202 knots in length) between Bonny and Prince's Island at a cost of £24,200, which will appear in the accounts for 1889. Cables have been laid by the Eastern and South African Telegraph Company between Loanda and Cape Town, thus completing telegraphic communication along the West Coast of Africa, and establishing duplicate and alternative routes to the principal stations of the company and to the Cape. The laying of these cables adds greatly to the security of the system in point of interruption of traffic. Arrangements have been made between the companies interested for working South African traffic in friendly alliance.

In view of these important matters, and the transfer to the Eastern and South African Telegraph Company of a large amount of the share capital of this company, the board has been reconstituted, and Sir John Pender, K.C.M.G., Sir James Anderson, and James Pender, Esq., have been appointed directors in place of three of the former directors who have retired. The meeting will be asked to confirm these appointments.

The directors who retire by rotation are Sir Henry Mance, C.I.E., and Robert Kaye Gray, Esq., and who, being eligible, offer themselves for re-election.

The meeting will also have to elect auditors for the current year.

The fourth ordinary general meeting of the company was held at Winchester House last Tuesday, Sir John Pender in the chair.

The Secretary read the notice convening the meeting, and the minutes of the last ordinary general meeting.

The Chairman then said: I presume we may take the report as read; but before I ask you to approve of the resolutions which I shall put before you I think it is right at this important meeting that I should make a few remarks, but they will be very few compared to the very great, I may say very important, work which has just been completed, and probably one of the most important works that has ever been done in connection with submarine telegraphy. If you look at the map you will see we have entirely surrounded Africa by telegraph, and we have connected every part of that great continent with submarine telegraph; that is a very great work in every sense of the word; great for the future of Africa, because every one is now endeavouring to take a part in the development of what is called the dark continent, and I think we have been ahead of every other party who has been attempting to do their part in the development of that country. Now, there can be no complaint of rapid communication when I tell you that the work starting from England itself has taken a no less length of cable than 16,281 nautical miles. This has not been done by one company, but by a combination of companies, and the policy of the companies over which I have had the honour to preside for so many years, has been that union of companies gives strength to the general system, and I think the result of this union will show to the shareholders, as well as to the world at large, that this has been a great work done. This union will add strength to the system, and, what is better than all, I believe it will enable us to pay a very respectable dividend, which, if we had been acting apart, would have been very doubtful indeed. Therefore, I think, when you take this great work and understand that some of the great submarine telegraph companies have been engaged in it—the Eastern Telegraph, 3,687 miles; Eastern Southern African, 5,829 miles; West African, 2,806 miles; the African Direct, 2,139 miles; and the Spanish National, 1,820 miles; making altogether 16,281 miles—you will see the result is satisfactory, and that a great work has been brought into one great system acting under a joint arrangement and joint powers. I think I may just close my remarks by saying that when we conceived this policy of union there were many difficulties to overcome; but I must say that we found the different companies with whom we conferred most friendly and well disposed, and that all admitted that under the general system, and having the Eastern at the head of it, it was not a bad omen for the future success of the company. With these remarks I beg to move that the report and accounts for the year ending 31st December, 1888, be adopted, and that a dividend be declared of 2½ per cent. for the year 1888.

Sir Henry C. Mance, C.I.E., seconded the motion, which was carried unanimously.

It was then proposed, in compliance with the articles of association, that the appointment of Sir John Pender and Sir James Anderson as directors be confirmed.

The motion was seconded and carried.

Sir John Pender: I thank you for the honour that you have done me in reappointing me. As you are aware, the company required to be reconstructed, at least the board required to be reconstructed to a certain extent, and while we regret the absence of the gentlemen who retired and whose places we have taken, I think they agree with us that such a reconstruction was necessary to work the system in perfect harmony.

Sir Henry Mance and Robert Kaye Gray were then re-elected directors of the company. Messrs. Deloitte, Dever, Griffiths & Co., were elected auditors, and a vote of thanks to the chairman brought the proceedings to a close.

The South of England Telephone Company, Limited.

At Winchester House, Old Broad Street, the sixth ordinary general meeting of this company was held on Wednesday last week, Mr. D. Owen Bateson, chairman of the company, presiding.

The Secretary, Mr. F. L. Robinson, having read the notice convening the meeting, the report and statement of accounts, as published in our issue of the 14th inst., were taken as read.

The Chairman then said: Gentlemen, since our last annual meeting we have lost one of our number. Mr. Campbell was one of our original directors, and, while his health lasted, was most regular in his attendance. His services were much valued by us as he brought to our consultations a mind of great business aptitude. His departure from among us, I assure you, was deeply deplored. Mr. Charles Billett was elected to the vacant chair, and, from our experience of his services since his election, I am quite convinced we have made no mistake in selecting him. The figures before you in the balance sheet show the progress of the company, and they are sufficiently full to require but very little explanation on my part. It will be noted that our expenditure on capital account amounted to £19,917. This exceeds last year by £3,460 5s. 9d., which is accounted for, in a great measure, by the increase of business, namely, by the establishment of 451 exchanges and 114 private lines, which, I think, ought to be satisfactory to the shareholders, as it results in a substantial increase in the gross rentals. On the other hand, tending towards the increased expenditure, there has been the rise in the value of copper wire. This is now over, for the present at all events, and we are now obtaining it at much more moderate prices than during the past months. Again, a good deal of money has been spent on trunk lines in the company's district for joining the different towns in which they have exchanges, so that when the good time comes when we shall be admitted into London only short lengths will be required to enable us to join hands with the metropolitan system. The revenue account amounts to £18,752, which shows an increase of rentals over the previous year of £4,928, but of this we have been obliged to transfer £9,041, which is an increase of £2,070 to the present year. The great activity in our business being in the summer months the unearned increment is proportionately large,

but this sum will be for disposal during the year we have entered upon. You will notice the large sum paid for royalties, £3,450. This is a heavy tax upon our resources, really amounting to 7 per cent. on the paid up capital. With respect to this item of royalties, I notice in a very able letter of the United Company to the secretary of the Post Office, a suggestion that the public will be better served if the tax imposed on telephonic communication were to be removed. I would suggest that it would be an additional service to the public and to this company if the royalties levied by the United Company on the subsidiary companies were abolished, or at least modified. This would strengthen the hands of the United Company in their suggestion to the Post Office, and be a good example for that department to follow. I am glad to see that since our last meeting we have obtained from the Stock Exchange a quotation in the market. This will be of considerable service to us, as it will make our shares—both preference and ordinary—much more valuable. The long-standing dispute with the United Company has been settled, and we have succeeded in reducing the claim from £1,845 to £1,265. This, I think, is a sufficient justification for your directors in having resisted what they considered to be an unfair demand. I am sorry to say we have made no progress towards connecting our district with the Metropolitan system. The demand for trunk lines from the subscribers still continues, but the United Company has not yet seen fit to grant anything in this direction, though we have constantly urged the matter upon their attention. I understand, however, that the United Company are running, as under our agreement they are undoubtedly justified in doing, lines through our district with the intention of connecting Birmingham in one direction and Bristol in another, with the metropolitan system, but why they are willing to grant accommodation to far-off towns, and refuse it to places contiguous to their own centre, and to people already subscribers, I cannot understand. We have reason to complain, too, that the United Company have been running lines, without consultation with us, as to the route they should take, so as not to interfere with our arrangements, and we think it would have been but a matter of ordinary courtesy had our views been asked before running the lines. On the whole, I think a little more regard might have been paid to the convenience of a company in whose success they have so great an interest. I hope the new management, as I expect there will be one, will put these matters on a better footing. There is another matter I should like just to refer to, namely, our relations with the Post Office. I notice there has been a good deal said, and some very hard words used, with reference to the treatment experienced by other companies from this department. I can only say with regard to this company that we have always received the greatest courtesy at the hands of that department. We know the terms on which we hold our license—that it is onerous enough—and we never try to go behind or beyond its requirements. We have never asked for anything that the Post Office has not granted, and as the terms of our license are sufficiently clear we can easily estimate the approximate value of our royalties, and having done this the cheque is forwarded without delay. I name this just to show that we have always worked without the slightest friction with the Post Office. As to the dividends, we propose to pay at the rate of 6 per cent. on the preference shares, which amounts to nearly £1,000 more than in the previous year; and we propose to pay one per cent. this year, as against half per cent. last year, on the ordinary shares. The balance of £627 1s. 2d. we intend to carry forward.

On the motion of the Chairman, seconded by Mr. Alexander MacGregor, the report and statement of accounts were adopted, after which the dividends declared by the directors and referred to by the Chairman were agreed to. The sum of £200 was also voted to the directors for their services during the year.

A Shareholder said he noticed that a trunk line had been run to Northampton, and he believed the United Company were running a trunk line to Birmingham. Were they to be connected with that line in any way, and were they going to be connected with the new Telephone Company? He understood that when the new company came out they were all to be connected with it and to form one happy family, but he had not seen anything to the effect that their company was to be connected with it. In fact, he heard that the negotiations of their company did not end satisfactorily, and he would like to ask if there was any chance of their company being amalgamated sooner or later with the larger company. The chairman of the United Company had said that the companies were uniting because the Postmaster-General was going about seeking what he might devour, and that union was strength. Would it not be better if they were also to join that company and enjoy the strength which union yielded?

The Chairman, in reply, said he rather agreed with the gentleman's remarks that union was strength, but up to the present the matter was in the hands of the United Company, and their company had never been approached on the question. Therefore, he did not know what was passing. As regards the Northampton line the United Company were certainly proposing to run a line between London and Birmingham. They had begun at the Birmingham end and had run to Northampton, but from Northampton to London nothing had yet been done as far as he knew.

The proceedings terminated with a vote of thanks to the chairman.

The India Rubber, Gutta Percha and Telegraph Works Company, Limited.—The half-yearly general meeting of this company will be held at the Cannon Street Hotel, London, on Thursday, the 11th instant, at 12 o'clock noon, for the purpose of obtaining the sanction of the shareholders to the payment of an interim dividend of 5 per cent., or 10s. per share, free of income tax. The company's share register will be closed from the 4th to the 11th instant, both days included.

TRAFFIC RECEIPTS.

The Direct Spanish Telegraph Company, Limited. The estimated receipts for the month of June were £1,600, against £1,690 in the corresponding period of last year.

The Eastern Extension, Australasia and China Telegraph Company, Limited. The receipts for the month of June, 1889, amounted to £39,350, as against £41,764 in the corresponding month of 1888.

The Eastern Telegraph Company, Limited. The receipts for the month of June 1889, amounted to £44,805, against £48,096 for the corresponding month of last year.

The Western and Brazilian Telegraph Company, Limited. The traffic receipts for the week ending 28th June, 1889, after deducting the fifth of the gross receipts payable to the London Platino-Brazilian Telegraph Company, Limited, were £2,017.

The West Coast of America Telegraph Company, Limited. The gross earnings for the month of June were £6,500.

The West India and Panama Telegraph Company, Limited. The estimated receipts for the half-month ended the 30th June are £2,750, as compared with £2,578 in the corresponding period of 1888.

LEGAL.

United Telephone Company, Limited v. Ahern and Co.—This action came before Justice Kay on Saturday as a short cause, the defendants not having appeared.

Mr. MICKLEM appeared for the plaintiffs, and said the action was brought on two patents, the Edison and Bell, and the statement of claim stated that the validity of these two patents had come in question in a previous action, and had been established, and certificates granted. With the statement of claim had been delivered particulars of breaches, setting out the various acts of which the plaintiffs complained, and the order asked for was that the defendants might be restrained from manufacturing, selling, supplying, or using any of the telephone transmitters mentioned in the particulars of breaches or any other instruments constructed according to the specification named.

JUSTICE KAY said he could not grant the injunction in that form, the defendants not appearing. He did not think the particulars of breaches formed part of the pleadings, and, therefore, he could only grant an injunction restraining the defendants from infringing the patents mentioned in the statement of claim.

Mr. MICKLEM said the minutes further asked an order that the defendants do within seven days from service of the order deliver up on oath all infringing instruments in their possession or under their control, for an inquiry as to damages, and in order that the defendants pay such damages within 14 days after certificate, and all costs, charges and expenses as between solicitor and client, according to Section 31 of the Patent Act of 1883.

HIS LORDSHIP made the order in this form.

ELECTRICITY IN AGRICULTURE.

WILL electricity for lighting or motive power purposes ever be employed to any extent in agricultural operations? This was the principal question in our minds last week, after making a careful examination of the exhibits at the Royal Agricultural Society's Show in Windsor Great Park. The exhibition was by far the largest held for several years past, there having been shown no less than 7,446 implements and machines. The exhibits germane to electric lighting were, as was shown in our last issue, very few, but even these represented more fully the science of electrical engineering than has been the case at any previous exhibition. Returning from this digression, the question raised is one which no doubt many electrical engineers who attended the show asked themselves. Indeed, in the course of our perambulations, we happened to overhear more than once the opinion expressed by different gentlemen as to what a good business might be done if only the machinery and implements exhibited could in actual working be driven by electrical power. The question naturally rises: Is there any reason why electricians should not participate in agricultural operations, in so far as lighting and motive power are concerned? The answer must be, generally speaking, in the negative; but let us see to what extent it is possible to utilise electricity for the purposes named.

In the first place, it would not be economic—in fact, we are convinced that it would be just the reverse—to

instal electrical machinery to be driven by steam engines, and we have arrived at this conclusion for two simple reasons—namely (1), that as the light and power would only be used upon a very limited area on account of the distance between one farming establishment and another, or one corn grinding and crushing mill and another, it would be a great loss to lay cables from one place to the next; (2) that few, if any, agriculturists would go to the expense of having an installation put up when they can manage so well with the power obtained from the steam engines now in use, and are tolerably well satisfied with their present systems of lighting. These two reasons are of themselves sufficiently weighty to demonstrate that electrical engineers have but little chance of doing business in this direction under the existing state of things. There are, however, two loopholes through which gleams of light may be seen, the first being in the utilisation of water power for driving dynamos by waterwheels or turbines. This is a very important matter. The conditions under which our agriculturists have to meet the keen competition from abroad are such that there is very little margin of profit left at the end of a business transaction, and if by any means they can place on the markets their produce at a more remunerative price by the substitution of some other power for that of steam, it is fair to suppose that they would not be long before adopting it. Now, in many of the agricultural districts throughout the United Kingdom there is available a plentiful supply of water power which is at present running to waste; but if this were used for operating turbines which would drive dynamos, both light and power could be obtained at a figure which would, comparatively speaking, doubtless be less than the cost of steam power, and oil or gas for lighting, as the case may be. Assuming that satisfactory arrangements could be made with private owners of the numerous watercourses which could yield a supply of power in this country, the matter deserves the serious consideration of our agriculturists. The second point to consider is, as to whether it is possible to make use of wind power for producing electricity. In this connection it may perhaps be well to refer our readers to a leading article entitled "Electricity produced by wind power," and which was published in our issue of May 24th last. In that article we gave some particulars concerning an electric light installation at a lighthouse near Havre, where the current is generated by a dynamo driven by a windmill or windmotor. Now, if in France such an installation, although on a small scale, has been a success, as is actually the case, there is no reason why we, in this country, should not take a leaf out of the book of our French neighbours and do likewise. It is of course impossible to form any definite idea as to what extent wind power could be employed for operating windmills or windmotors which would drive dynamos, but we are strongly of opinion that sufficient power or light could be obtained which would within, say, four or five years, fully recoup agriculturists for their initial outlay in prime movers. The objections usually advanced against the use of windmills for power purposes are the periods of calm, the irregular velocity of the wind, and the imperfect construction of the windmills. It is naturally obvious that the first objection cannot be surmounted, but the second disadvantage could be overcome by the adoption of windmotors, fitted with automatic apparatus for the opening or closing of the sails, according to the velocity of the wind, as is done in the case previously mentioned, whilst the third objection could be surmounted. It is therefore to be hoped that British agriculturists will give this matter also their serious consideration.

Let us now consider what are the machines or implements which could be driven by electrical power? Traction engines, and, in fact, all those used in the open, such as reapers, haymakers, mowers, ploughs, harrows, &c., must be considered as out of the question, as they could not be economically or easily operated from accumulators, and the idea of their being driven by motors is not feasible. Those machines or implements capable of being worked by electrical power are thrashing, dressing, and finishing machines, elevators, pumps, hay and straw presses, corn grinding and crushing mills, &c. The advantages of the electric light would, of course, be great as compared with the present inefficient system of oil lamps, candles, or gas where it is obtainable. The fire risks would naturally be great, but installations put up by competent electricians would be perfectly safe. We must not omit to mention how extremely useful electrical power would be found in dairies for driving cream separators, milk elevators, butter printing machines and workers, &c.

In conclusion, we find that in the United Kingdom electric lighting and power could not be employed to a large extent in agriculture for the reasons already given, that the only way in which electricity could be introduced would be by driving the dynamos by water or wind power, and that these are the only ways in which it could be done economically.

REPORT ON THE FIRST SIX MONTHS' WORKING OF THE ELECTRIC AND ALLIED TRADES' SECTION OF THE LONDON CHAMBER OF COMMERCE.

THIS section was finally organised at a meeting of the trade held on the 22nd October, and a working committee was then elected. The committee was divided into the following sub-sections:—Telegraph Companies, Telephone Companies, Electrical Manufacturers and Contractors, Electricity Supply Companies, Consulting Electrical Engineers, and General Engineers. The electricity supply sub-section was the first to get to work; on the 16th November it met, and considered the relations between the supply companies and the local authorities in regard to licenses and provisional orders. It recommended the executive committee to memorialise the Board of Trade that the unit should be increased from 1,000 to 10,000 watt hours, also there should be united action on the part of undertakers in dealing with the question of paying the legal expenses of local authorities, as in some cases such payments had been demanded. It also asked the committee to urge all the electric supply companies to stand firm on the question of declining to sell undertakings at a shorter period than the 42 years' limit obtained under the recent Act, that supply companies should require two years as the minimum period in which compulsory work should be carried out, and that the model forms of accounts and general regulations for the electric supply companies proposed by the Board of Trade should not be issued until the supply companies had been at work for at least a couple of years, in order that these rules and forms of accounts might be issued after reasonable experience had been obtained to suggest the best form for them. These recommendations were confirmed by the committee at a subsequent meeting and communicated to those interested in the trade.

Early in the year a sub-committee was appointed to consider the proposal of pushing the question of obtaining a Government laboratory for standardising electrical measuring instruments, and it was decided to take common action with the Institute of Electrical Engineers. Accordingly a joint committee was appointed, which met several times, and eventually, on the 19th June, an influential deputation representing the Chamber of Commerce and the Institute of Electrical Engineers, attended at the Board of Trade, and laid before the President a scheme and estimate for such a laboratory. The deputation was favourably received, and there is every reason to believe that the matter will no longer be shelved.

The question of overhead wires was taken up on the 4th February by a committee appointed to examine the matter. This committee held several meetings, and eventually has succeeded in obtaining a copy of the draft regulations intended to be issued by the Board of Trade for the regulation of overhead wires. The com-

mittee hope to be able to obtain some modification of some of the more stringent regulations proposed by the Board of Trade, and which appear to press hardly on the trade. At any rate, they have good reason to believe that their representations will secure the issue of the rules in a modified form for country installations.

A committee was appointed to see whether some modification of the Chamber of Commerce rules respecting arbitrations could not be made so as to invite members of the Electric Trade Section to avail themselves largely of such arbitrations as a convenient method of settling disputes in the trade, and eventually the permission of the General Council was asked to the following modification :—That as disputes on electrical matters at present were somewhat complicated, and involved much expert knowledge, that disputants should, if they so agreed, be permitted to avail themselves of the services of Council and expert witnesses in arbitrations otherwise under the Chamber's rules.

A committee was appointed to consider whether a standard form of specification could not be drawn up for the convenience of consulting electrical engineers on the lines of the specification very generally used by architects and builders. It was found, however, that for the present such a form of specification was not generally called for, and the idea was abandoned.

The question of the railway rates under the new Railway Act was considered as far as it referred to electric trades. A sub-committee prepared a report on this subject, which was presented to the general committee on May 13th, and it was subsequently revised according to the form adopted by the Chamber of Commerce generally, and finally lodged by the Board of Trade and railway companies on June 3rd.

The Electrical Section enjoys great advantage in such cases in being able to avail themselves of the great experience and prestige of the Chamber of Commerce itself, on a matter which so greatly affects the future commercial interests of every member of the trade.

After the experience gained during the first three months the Committee of the Section decided that the amount of useful work done could be greatly increased if the Section secured the services of a gentleman thoroughly acquainted with the trade, to act as the Section's correspondent, and after due permission had been obtained from the Council of the Chamber it was decided to ask Mr. Trotter to accept the post. Mr. Trotter kindly consented to this, and the result has been shown in the greatly increased volume of the useful work which has passed through the hands of the committee since the date of his appointment.

PRECIPITATION OF SEWAGE BY ELECTRICITY.

THE London County Council on Tuesday last at their weekly meeting at the Guildhall, had under consideration a report of the main drainage committee, brought up by Mr. J. G. Rhodes (chairman of the committee). This document stated that in connection with the experiments about to be carried out by Mr. W. Webster at Crossness, for the precipitation of sewage by electricity, it would be necessary for the Council to engage temporarily the services of an electrician, and having conferred with the chemist, they recommended :—

"That Mr. J. N. Shoolbred, of No. 1, Westminster Chambers, be engaged for this purpose during the month of July, at a fixed fee of 25 guineas in addition to his travelling expenses."

The chemist had submitted to your committee the following estimate of lime and sulphate of iron required for precipitating the sewage at the Barking Outfall Works as soon as the engineering operations were completed, viz.—*Lime.*—25 tons per day for 365 days = 9,125 tons. *Sulphate of Iron.*—Six tons per day for 365 days = 2,190 tons.

The committee recommended and the Council approved :—

"That advertisements be issued inviting tenders for the supply of these quantities, and that, as further supplies of sulphate of iron are required at Crossness, 100 tons of the above be delivered to that station."

THE ELECTRIC LIGHT FOR MANCHESTER.

THE *Manchester Guardian* says :—"If Parliament takes a favourable view of the Provisional Orders that are presented to it during this and next session, we may expect before very long to have something like 50 central stations at work in the provinces for the supply of the electric light.

"It seems probable that at least one of the 50 stations will be in Manchester. In the year 1879 Sir Joseph Heron informed the Royal Commission appointed to take evidence on the question of electric lighting that 'great interest was taken by the Corporation of Manchester in the question of electric lighting,' and that 'though they were deriving large profits from the gasworks they were perfectly ready to introduce the electric light when proved to be desirable in the public interest.' The Corporation have now an opportunity, of which it cannot be doubted that they will avail themselves, of showing that in what he said 10 years ago the Town Clerk gave expression to their views. Some time ago the Manchester Edison-Swan Company sent to the Corporation an application for permission to establish a central lighting station in the city. Their idea, as submitted to the Corporation, was to establish a station somewhere within half a mile of the Royal Infirmary for a maximum of 10,000 lights. They believed that charging an average of something like 25s. per light, they could make such a station a financial success, and a source of benefit to the shopkeepers and others in the centre of the city who might use the light. The Corporation, or rather the sub-committee to whom the whole question of electric lighting was referred, appeared to think that the representatives of the company took rather an exaggerated view of the public demand for the electric light. At all events, they asked to be supplied with more definite information on the point. A canvass was made, with the result that it was found that the company had under-estimated rather than over-estimated the demand for the light amongst the section of the public who have shops, warehouses, clubs, and other premises in the centre of the city. 'Subject to a satisfactory arrangement as to price,' the people who were canvassed indicated their willingness to take 15,000 lights—50 per cent. more than the original estimate. This information has been submitted to the Sub-committee of the Corporation. Since the Manchester Edison-Swan Company took the matter up the Anglo-American Brush Company have also made application for permission to establish a central station in Manchester. Each of the companies, as we understand, is desirous of acting to the fullest extent in concert with the Corporation, and of offering what may be considered a reasonable consideration for the privilege they seek to obtain. On the other hand, in the improbable event of the Corporation refusing to have anything to do with the project, the companies appear determined to fall back on the Act of Parliament and to endeavour to get a provisional order empowering them to do the work independently of the Corporation. The Sub-committee of the Corporation have not as yet given any public indication of their views in the matter, and it is well, no doubt, that there should be no undue haste in arriving at a decision. From statements that are being made unofficially, however, we gather that the Sub-committee are not disposed to regard with favour any proposal to let either of the two companies secure Parliamentry powers of their own for the lighting of the centre of the city by electricity. It is thought that, as with gas and water, so with electricity, the supply should be to as great an extent as is wise and practicable in the hands of public bodies. With this object in view, the sub-committee will probably recommend the Council to apply for powers themselves, not with the intention of becoming producers and vendors of the electric light, but in order that they may licence a company or companies to supply the electric light in certain districts under certain conditions. The conditions will no doubt include the payment of a royalty to the gas committee on account of any diminution that may take place in the consumption of gas in a given district in consequence of the introduction of the electric light. The circumstance that the Corporation are the owners of the gasworks, in which so large an amount of the ratepayers' money is invested, heightens, of course, the complexity of the question now under consideration. But that this circumstance will have a deterrent effect on the Corporation is not likely. In places in which the electric light has already made room for itself, there has not been in consequence any perceptible falling off in the demand for gas, and so, we may hope, it will prove in Manchester. Even if the electric light were to entirely supplant gas as an illuminant —which it seems not at all likely to do for many years to come— there will still be a great future for gas as a motive power. While the Corporation will show due caution in the matter, it is for these reasons unlikely that they will be to any extent influenced by the fear that the introduction of the electric light will place the gas undertaking in jeopardy."

ELECTRIC LIGHTING IN BRADFORD.

BOARD OF TRADE BYE LAWS.

UNLESS objected to, and the objections are duly forwarded to the Board of Trade before the 6th of July, the mayor, aldermen and burgesses of the Borough of Bradford will apply to the Board of Trade to confirm the following bye-laws in connection with the Corporation supply of electricity :—

"The Board of Trade, in pursuance of the power vested in them in that behalf, hereby make and ordain the following bye-laws for the better ensuring safety in the supply of electricity by the mayor, aldermen and burgesses of the said borough, hereafter called the Corporation, pursuant to the provisions of the Electric Lighting Act, 1882, and the Act of 46 and 47 Vic., cap. 220, confirming the Bradford Provisional Order for such supply of electricity, that is to say :—

"1. All wiring, fittings, apparatus and other appliances, must be supplied and fixed in accordance with the 'Rules and Regulations of the Society of Telegraph Engineers and Electricians' (April, 1888), and of any other regulations which the Corporation may require.

"2. The sectional area of all conductors shall be so proportioned that the maximum current conveyed in any conductor shall not exceed the ratio of 1,000 ampères per square inch of section of copper conductor. No portion of the metal work of any brackets, electroliers or other electrical fittings, or of any gas or water pipe, is to be used as part of the electrical metallic circuit, as 'earths' might readily be formed by any such connections.

"3. The insulation resistance of the entire installation (when all the mains, wires, fittings, lamps, motors and other appliances are fixed), shall not, as proved to the satisfaction of the Corporation, be less than the total number of ohms, which shall be indicated by the number resulting from the division of 10,000,000 by the number expressing the maximum electric current in ampères, which has been named by the consumer in his application for his supply of electricity. In the event of the insulation at any time falling below the above standard, and continuing so, the Corporation may, after due notice, discontinue the supply of electricity to the premises.

"4. Should it be found that any consumer is using a current in excess of the maximum with which he has required the undertakers to supply him without notice having been given in accordance with the Act, the Corporation may, if they think fit, discontinue the electric supply to this consumer until they have made proper provision for such increase.

"5. All connections direct with 'earth,' or connections tending to cause 'earth,' such as with gas or water pipes, or other metallic bodies are absolutely forbidden, without the express sanction in writing of the Corporation.

"6. Should any such 'earths' be at any time found to exist in an installation, whether through an intentionally made connection or by neglect of any of the prescribed regulations, as to wiring or as to fittings, or from any other cause, the Corporation, if they deem it necessary or advisable, may discontinue, even without notice, the supply of electricity to the installation, until such 'earths' or other defect has been made good by the consumer to the entire satisfaction of the Corporation, and so notified in writing.

"7. All dead ends which may occur in the installation should have their extremities carefully sealed up, so as to avoid all chance of 'earths' being formed therefrom.

"8. Should any leak, or 'earth,' or other serious defect be discovered by the consumer, either within the installation itself, or in its immediate vicinity outside the premises, he is bound at once and without delay to give notice thereof to the Corporation or their electrical engineer, so that the defect may be at once properly remedied.

"9. Two switches, one on each main respectively, shall be fixed, in a readily accessible position, on the two mains leading from the meter to the premises, at a point immediately adjacent to the meter, if possible, and subject to the approval of the Corporation, or their electrical engineer. These switches must be so arranged, that the entire of the current passing into the installation can be, when necessary, cut off by them.

"10. The proper officers of the Corporation shall have the right of access at all times to these switches.

"11. In the event of any alterations, repairs, extensions, or other interference, from whatever cause, with the ordinary working of the installation, notice must be given to the Corporation or their electrical engineer, at least twenty-four hours before such alterations or other operations commence; and indicating the time at which it is intended to commence such operations.

"12. During the entire time, whether continuously or with interruptions, that such alterations or other operations are in course of execution, the electric supply from the outside must be entirely disconnected from the premises by means of both of the above-named main disconnecting switches. Any exception to this regulation must have the express sanction in writing of the Corporation or their electrical engineer.

"13. In the event of the electric supply not being properly and efficiently cut off from the premises whilst such alterations, repairs, or other operations are being carried on, the officers of the Corporation may, if they deem it necessary, even without notice, completely interrupt the electric supply to the premises, in any way which they think advisable.

"14. Whenever any disturbance or other interference may be required or contemplated, with the surface or other parts of any street, causeway, pavement, or any other place in the vicinity of any electrical cables, wires, or other apparatus or matter connected with the public supply of electricity, the person or body charged with carrying out the above-named disturbance, or interference with such street, or other places, shall give notice in writing of such intention to the Corporation.

"15. Such notice should, where possible, be delivered at least twenty-four hours before the commencement of such intended disturbance or other interference.

"16. The notice should also designate the locality of such intended disturbance, &c., as also the time at which such operations are proposed to be commenced, so as to allow of the attendance at such locality of an official from the electrical engineer, in order to point out the exact position of the electrical cables, wires, and other apparatus, and also that he may take any steps required for the proper protection thereof.

"17. Any person offending against or not complying with any of the above regulations, shall be liable to a penalty, not exceeding £5, and a daily recurring penalty not exceeding such sum, so long as the offence or neglect may continue.

"18. In the above bye-laws, the term electrical engineer shall mean the person whom the Corporation may, from time to time, appoint to take charge of their electrical works.

"19. The Corporation shall appoint an office in the Town Hall where all notices may be served in connection with the above bye-laws."

ELECTRIC LIGHTING IN LAMBETH.

STREETS SCHEDULED BY THE BOARD OF TRADE.

THE subject of negotiations between the Board of Trade, the Metropolitan Electric Supply Company, and the Lambeth Vestry, for the lighting of the parish, came up at the meeting of the Vestry on Thursday, June 28th.

Mr. C. W. ANDREW, the chairman, who is also the chairman of the Electric Lighting Committee, submitted a lengthy report, stating that their clerk had asked to have the following streets scheduled to the London Company's Order as the compulsory area, viz. :—Waterloo Bridge Road, Westminster Bridge Road, Belvedere Road and Commercial Road, New Cut and Lower Marsh, York Road and Stamford Street, and Oakley Street. And the following streets scheduled to the Metropolitan Company's Order, in addition to the above-mentioned streets, viz. :—Lambeth Road, Albert Embankment, Kennington Road, Upper and Lower Kennington Lane, Harleyford Road, Kennington Oval (one side), Harleyford Street and Camberwell New Road, Wandsworth Road, South Lambeth Road and Stockwell Road, Kennington Park Road, Clapham Road, Brixton Road, Brixton Hill, Coldharbour Lane, Acre Lane, Effra Road, Tulse Hill, Denmark Hill, Herne Hill, Norwood Road, Knight's Hill, Water Lane, Dulwich Road, and Gresham Road. At a meeting at the Board of Trade, before Mr. Boyle, C.B., and Major Marindin, at which were present representatives of the two companies and the Vestry clerk (Mr. H. Smith), two points were discussed, viz. :—(1) What streets should be scheduled as a compulsory area in which the company were to be bound to lay down mains within two years from the commencement of the Order; and (2) On what terms owners and occupiers could compel the company to supply electricity to premises outside the compulsory area. As to the London Company's proposed district—viz., the part of the parish north of Westminster Bridge Road—after considerable discussion, it was agreed by the representatives of the two companies, with the approval of Mr. Boyle, that one company should include as part of their compulsory area Waterloo Road, Belvedere Road, Commercial Road, York Road, and Stamford Street; and the other company should include Westminster Bridge Road, Lower Marsh, and the New Cut. Under this arrangement all the streets asked for by the Vestry would be included, except Oakley Street. As to the part of the parish outside the proposed area of the London Company—viz., the part lying to the south of the Westminster Bridge Road up to the southern boundary of the parish at Crown Hill, Central Hill, and Westow Hill—the Metropolitan Company agreed to include in their compulsory area Kennington Road, Kennington Park Road, South Lambeth Road, Clapham Road to the Swan, Camberwell New Road to the Vassall Road, and the Brixton Road to the White Horse public-house, at the foot of the Angell Road; and after much pressure the company agreed to extend the area along Brixton Road to Brixton Church and up the Effra Road to Water Lane, but no farther. The clerk pointed out that under this area no provision was made for any part of the Norwood Ward, and that it would be therefore impossible for the Vestry to assent to the Order. Mr. Boyle also expressed strongly his opinion that some provision should be made to extend the area to a part of Norwood, and a suggestion was made that the line should be carried over Tulse Hill to the Tulse Hill Hotel in the Norwood Road. This the company declined at the time to accede to, but promised to consider the matter and communicate with the Vestry. The clerk the day after the meeting wrote to Mr. Boyle, pointing out that in any case Wandsworth Road should be in-

cluded in the compulsory area, and on June 24th received the following letter from the Board of Trade:—

"Metropolitan Electric Supply Company.
"South London Lighting Order.

"21st June, 1889.

"Sir,—With reference to the interview which recently took place at the Board of Trade between the representatives of your Vestry and the Metropolitan Electric Supply Company, Limited, on the subject of the list of compulsory streets to be scheduled to the above-mentioned order, I am directed by the Board of Trade to forward to you the enclosed copy of a letter which they have received from Messrs. Bircham & Co., agents to the promoters, and to inform you that the Board of Trade propose to schedule to the order the streets referred to in the letter.

"I am, Sir, your obedient servant,
"COURTENAY BOYLE.

"The Clerk to the Lambeth Vestry."

"Metropolitan Electric Supply Company.
"South London Order,

"46, Parliament Street, S.W., June 20th, 1889.

"Dear Sir,—The company have now very carefully considered the question as to the compulsory laying down in streets, more especially with a view to giving you an answer with reference to Wandsworth Road, and they submit that the following streets are the only ones which should be scheduled, because they are the only ones in which in the immediate future there is any likelihood of there being any demand for electric lighting. Of course, as soon as there is any demand at all for electric lighting, they would be quite willing, indeed anxious, to lay down mains in the streets; but they would submit that, as the mileage of the street mentioned is certainly upward of six miles, the case would be sufficiently met by scheduling those streets. We are not sure that we have exactly the same description of the streets in the Wandsworth district as that taken down when we attended before the Board, but the streets are the same.

"Wandsworth District.—From Streatham Church down High Street and Streatham Hill to Streatham Hill Railway Station; Clapham Road, Clapham Common (both sides), High Street, Clapham, and the Pavement (Clapham).

"Lambeth Parish.—Waterloo Bridge Road, Westminster Bridge Road, Belvedere Road, Commercial Road, York Road, and Stamford Street.

"Yours, &c.,
"(Signed) BIRCHAM & Co.

"Assistant Secretary, Railway Department,
"Board of Trade, S.W."

The CLERK reported as under with reference to the terms of supply outside the compulsory area: "That the model order as settled by the Board of Trade (Clause 22) enabled any six or more owners of premises along any street, or where the local authority has the control of the public lamps in such streets, then for the local authority to make a requisition on the company; but if such requisition is made by the local authority, then (under Clause 24) such local authority must engage to take for three years a supply of energy for lighting the public lamps in such street, and if such requisition is made by six owners or occupiers, the company can, under Clause 23, by notice, require such owners or occupiers to take for three years a supply of energy as at the rate charged by the company will produce annually such reasonable amount as shall be specified by the company, not being less than 20 per cent. of the expense of providing and laying down the distributing and other mains, or additions necessary for the supply, and the owners or occupiers can be required to sign an agreement to pay the 20 per cent. annually for three years, and to give security for such payment."

Mr. SMITH further reported that he had pressed upon Mr. Boyle the hardship of the proposed arrangement, as the cost of mains should be paid by the company, and that the prices allowed by the order were really based upon the principle that the cost of the mains were paid by the company and not by the consumers; that the proposed arrangement would be very unequal between the occupiers of the premises in the compulsory area and those outside the area; and that it would throw upon the six requisitionists the cost of laying down the mains which, when laid down, could be at will and ever afterwards used by other owners and occupiers in streets in which the mains were so laid under clause 43, without being called upon to contribute to the outlay of the six requisitionists or to recoup to them any part of such outlay. Further, the clerk had contended that all the requisionists should be called upon to guarantee was the payment to the company for a specified time, of a definite quantity of energy, but that this should not be dependent on the cost of laying mains. Major Marindin admitted that some arrangement should be made to relieve the requisitionists from part of their guarantee should others along the route of the new mains take a supply of energy, and the London Company's solicitor acknowledged that with reference to one parish the company had agreed to accept such a provision. No intimation had, however, been received from the Board of Trade that such a provision would be inserted either in the London or Metropolitan Company's order.

Mr. ANDREW stated that after fully considering the report of the clerk and the letter from Mr. Boyle, the committee unanimously resolved to recommend the Vestry to address a strong remonstrance to the Board of Trade against any order being given to either company, unless as to the London Company's district, the one or the other company undertake to include all the streets agreed to before Mr. Boyle, adding Wandsworth Road, but make a proper provision for the Norwood Ward, and that the Board's attention be called to Mr. Boyle's opinion as to the Norwood Ward. Should the Board of Trade, notwithstanding the remonstrance, sanction the orders, the committee recommended the Vestry to instruct their clerk to oppose the order in Parliament when presented for confirmation, and that in such opposition the Vestry should ask that all the original streets first mentioned in this report should be comprised within the compulsory area, and that the liabilities thrown by clause 23 of the model order upon the private requisitionists should be lessened, and the cost of all mains thrown upon the company.

Mr. SMITH (the vestry clerk), explained in detail the leading features of the report.

Mr. HONEY then moved that the vestry clerk take all necessary action to defend the interests of the parish, whether by opposing the order, petitioning, or otherwise.

Mr. PHILPOTT seconded the motion, and it was carried.

ELECTRIC LIGHTING AT SOUTHSEA.

ON Thursday evening last week, by invitation of the South Hants Electric Supply Company, Limited, several members of the Portsmouth Town Council, and other well-known commercial gentlemen, inspected the temporary installation of the electric light which has just been supplied by the Laing, Wharton and Down Syndicate to the Esplanade Hotel, Southsea. A meeting followed, at which Mr. John Brickwood (of the firm of Brickwood Brothers, brewers), occupied the chair. Mr. Bate, as representing the electric lighting syndicate, delivered a short address with reference to the position occupied by that company in reference to Portsmouth. Four years ago, when he first came into the town and commenced to canvass, he found that the commercial community were not yet ripe for the electric light, but since then a great change had supervened, and, in view of this fact, they recently applied to the Roads and Works Committee for permission to erect overhead wires temporarily. He said temporarily, because under a Provisional Order they would be rendered liable of £10 for the first day, and £5 for every other day afterwards that they kept their overhead wires running over the two years intended by the Board of Trade licence. The committee had refused the permission requested, but he could not help feeling that they had done so under a misapprehension. They were, of course, quite certain that permanent overhead wires would not be permitted in a town like Portsmouth; but he did think that if the committee had fully appreciated the reason why they asked for sanction to run overhead wires for a term of two years the application would not have been refused, especially as the same facilities had been granted by every other Corporation that they had approached up to the present time. No company which attempted to run underground mains from the first had ever been a financial success. In the course of two years the demand which there was likely to be for the electric light would be pretty accurately known, and then they would be enabled to take up the streets once for all and effect the work very much more cheaply than could possibly be done piecemeal. It was not a fact, as some seemed to think, that they would require hundreds of wires. The circuit would run up one street and down the other, but there would not be a number running on one pole as in the case of the telegraph or telephone. Already they had one hundred orders in different parts of the borough, but they could not move in the matter until they had obtained a provisional order. No doubt need be entertained that the syndicate which he represented could find the largest amount of capital which could possibly be required for the introduction of electric lighting into Portsmouth.

In answer to the Chairman, Mr. BATE explained that in the event of the Corporation giving their consent to the running of overhead wires permanently, they would, of course, incur no penalty for running over two years.

Mr. W. J. TUCK: Will you continue to go on with your orders even supposing you have to put your wires underground from the first?

Mr. BATE: The committee having told us that they would not allow anything except under a provisional order, in deference to their wishes we apply for one.

Mr. TUCK: But doesn't it strike you that other companies might start in Portsmouth and we might have a succession of overhead wires?

Mr. BATE: No, that does not strike me, because the Board of Trade would scarcely permit two rival companies to operate in the same district. They might apportion Landport to one and Southsea to the other.

Mr. B. C. MILLER said that another company was applying for a Provisional Order. The Council only desired to see fair play.

Mr. TUCK, in moving a vote of thanks to the Chairman and to Mr. Bate, said that the electric light was, he believed, the light of the future. No unreasonable obstacles ought to be placed in the way of any company which was worthy of support.

Mr. FREEMAN seconded, and the motion having been carried the proceedings terminated.

THE COMPOUND-WINDING PATENTS.

KING, BROWN & CO. *v.* ANGLO-AMERICAN BRUSH ELECTRIC LIGHT CORPORATION.

IN the Court of Session, Edinburgh, on Wednesday last week, Lord Trayner gave judgment in the action by King, Brown & Co., Rosebank Electric Works, Edinburgh, against the Anglo-American Brush Electric Light Corporation, Limited, 6, York Place, Edinburgh, for reduction of letters patent granted in October, 1878, for improvements in apparatus for the generation and application of electricity for lighting, plating and other purposes.

LORD TRAYNER said: The question to be determined in this case is whether Mr. Brush is the inventor of (1) the peculiar form of commutator; and (2) the series-shunt machine for which the letters patent now under reduction were granted. In regard to both, the pursuers maintain that Mr. Brush is not the first and true inventor, and that both had been publicly known and used prior to the date of the letters patent. To some extent the determination of the question at issue depends upon the construction of Mr. Brush's patent obtained in 1878 and the patent obtained by Mr. Varley in 1876; to some extent, also, on matters of fact which are disputed. A long proof has been led before me from which it was not possible at the time to exclude evidence which ultimately resolved itself into expressions of opinion as to the meaning and construction of the two patents. In forming my judgment upon the questions submitted to me, I have carefully considered the proof, in so far as it was necessary thereby to instruct myself on scientific theory and detail, and in that respect I have obtained great assistance from the evidence adduced on both sides. I would like to add that I have been greatly assisted also by a remarkably able argument from both sides of the Bar. But in construing the letters patent I have put aside the different views of the witnesses on both sides, as construction is a matter for the Court, and not for the witnesses.

In disposing of the case I shall deal separately with the questions connected with the commutators and the series shunt machine.

First.—As regards the commutator, Mr. Brush describes his invention in the provisional specification in these terms:—"In constructing commutators cylindrical with an insulating hub or body to which are attached metallic sub-segments placed in electrical connection with the general mechanism in which the commutator is employed, and metallic wearing sub-segments detachably attached to said sub-segments." This is said to have been anticipated by Varley's commutator and the Manchester commutator, both of which have been produced. With regard to both of the last-mentioned commutators, I think it may be said that they are cylindrical, with metallic sub-segments having metallic wearing segments detachably attached. They, also, had an "insulating body," or, I should rather say, "insulating substance," for the word "body" is ambiguous. Yet with all these points of similarity I do not regard them as anticipations of the defenders' commutator. The insulating hub or body of the defenders' commutator is the "body" or basis on which his commutator is constructed—to which the various parts of his commutator are attached. This cannot be said of the Varley or Manchester commutator, in which the insulating substance does not form the body or basis of the commutator at all, and insulates not the whole commutator, but only one section of it. The purpose and effect of the Varley and Manchester commutators, electrically considered, were, in my view, the same as Brush's commutator; but it is not in that view that Brush claims that his commutator is a new invention. He claims it merely as a mechanical device or arrangement having certain advantages over existing arrangements used to serve the same purpose, and, as a mechanical arrangement, I think it was new and useful, and not open to challenge. But the pursuers maintain that the letters patent under reduction are rendered invalid by reason of the patentee claiming in his final specification (as amended and disclaimed) something with reference to this commutator as an invention which is not foreshadowed in the provisional specification. The claim here referred to is the fourth, which is in these terms:—"The commutator having metallic insulating segments, T, substantially as shown in division three. It appears to be necessary, or at least desirable and advantageous, to cut the armature bobbins out of circuit when they are crossing the neutral or current-reversing points of the magnetic field. To do this the continuity of the current conducting segments of the commutator has to be broken, either by a mere space or by the insertion of some non-conducting material at the given point. The cutting of the bobbins out of circuit was known and practised before the date of the defenders' patent; but it was not before then done by means of an insulated metal segment. The advantage which attaches to the defenders' method is this, that the insulated segment being metal like the conducting segments, there is insured a certain uniformity of wear over the entire surface of the commutator which could not be preserved where a softer material like wood was used, or where merely a space was left. I am not aware that prior to the defenders' patent, any insulating body, metal or otherwise, was ever used in the construction of the commutator, for the purpose of cutting the bobbins out of circuit. The insulating segment, T, of the defenders' patent was therefore a novelty, and its utility I do not understand to be disputed. But was it foreshadowed by the provisional specification?—I think not.

In the first place the defenders' second claim seems to me to be co-extensive with the provisional specification (in so far as it relates to the commutator), so that there was nothing left to claim under another head. If all that was foreshadowed in the provisional specification is included in the second claim, then the fourth claim (unless regarded as mere repetition, which nobody suggests), is for something not there foreshadowed. Secondly, the provisional specification relates only to the construction of a cylindrical commutator, whereas one of the chief purposes of, and one of the main advantages to be derived from the insulating segment, T, is the preservation or maintenance of the cylindricity of the commutator, an object probably as important and as patentable as, but quite distinct from, the shape or mode of construction. Thirdly, the insulating segment, T, is not merely or necessarily a part of the cylindrical commutator having sub-segments with wearing segments detachably attached. It has, and is intended to have, a peculiar function which is not referred to in the provisional specification at all. Fourthly, it is said that the segment, T, is a part of the wearing segment, and, therefore, falls within the description of the provisional specification; but I think this is not so. The wearing segment is an essential part of the defenders' commutator; the segment, T, is not, it may be dispensed with altogether.

I come, therefore, on this part of the case, to the conclusion that the patent sought to be reduced is invalid in respect to the invention claimed in the final specification, is larger and different from that claimed in the provisional specification.

It is right, notwithstanding what I have said, that I should also express my opinion upon the remaining question in the case, viz., was Mr. Brush the inventor of the series-shunt machine, or had that invention been anticipated by Varley? For the pursuers it is maintained that Varley disclosed and published the invention of a series-shunt machine in his specification and patent of 1876, and constructed a machine in conformity with that specification, which was a series-shunt machine, and was publicly used as such in 1877; the defenders' patent, as I have said, is dated in 1878.

In considering whether the description given by Varley in his specification amounts to a publication of the invention claimed by the defenders, it is necessary to bear in mind the two different kinds of winding used in dynamos known at the time when Varley's specification was lodged. The first of these was the *series*. In the series machine one wire was coiled round the magnets, and the current sent along this wire served both for the excitation of the magnets and the performance of the external work. There was thus one wire and one circuit. In the second, the *shunt* machine, there was again only one wire coiled round the magnets, but the electricity developed by the machine instead of being entirely conducted in one circuit (as in the series machine) was bifurcated immediately as it left the machine, and one part went wholly to the excitation of the magnets, while the other went wholly to the performance of the external work. The current was thus divided in two, each part of which formed a branch or circuit quite independent of the other. The defects or weak points in each of these machines has been clearly explained by Mr. Imray, and need not here be repeated. These defects found their remedy in the third kind of machine, now known as *series-shunt*, which, speaking generally, is a compound of the other two; it is in effect a series machine with a shunt added to it. In this machine the magnets are wound round with two insulated wires, one having a higher resistance (the shunt coil) than the other (the series coil). The electricity produced by the machine is diverted or bifurcated immediately after it leaves the armature; part of it is taken by the shunt to magnetise the magnets; the remainder of it being conducted by the other wire (the series) so as to (1) excite the magnets and (2) perform the external work. The shunt circuit is always closed, the other may be either closed or open. Thus, whether the series circuit is closed and is exciting the magnets and doing external work, or is open and conveying no energy, the shunt circuit is engaged in keeping the magnets sufficiently magnetised. For if the series circuit is open, the only path from the armature being by the shunt, more of the energy produced in the armature will pass through the shunt circuit and the effect of the shunt in exciting the magnets will be increased, thus compensating for the absence of any excitation from the series circuit. The magnetisation of the magnets is in this manner maintained, so that the machine is kept ready to do full work on the series circuit being again closed.

I turn now to Varley's description, which for convenience I here quote. He says, describing his machine, "Part of the electricity developed by the machine is diverted to maintain the magnetism of the soft iron magnets, and the remaining portion is used to produce the electric light. There are several well-known ways of doing this, but the method I prefer is to wrap the soft iron magnets with two insulated wires, one having a larger resistance than the other. The circuit of large resistance is always closed, and the circuit of less resistance is used for the electric light. When the electric light is being produced, the greater portion of electricity passes through the circuit of less resistance, which I term the 'electric light circuit,' maintaining the magnetism of the magnets and producing the light. When the electric light circuit is opened from any cause, the electricity developed passes through the circuit of greater resistance only, and maintains the magnetism of the magnets."

In this description I find disclosed: (1.) That the electricity developed by the machine is diverted or divided, one part going to maintain the magnetism of the magnets, and the remainder going to produce the electric light. (2.) That the method by which this may be accomplished (and the method which Varley prefers) is

by wrapping the magnets with two insulated wires, one having a larger resistance than the other; (3) that the circuit of larger resistance is always closed, and the current passing through it maintains the magnetism of the magnets, and (4) that the current passing through the circuit of lesser resistance is used for "maintaining the magnetism of the magnets and producing the light." These four things appear to me to comprise every distinctive feature of a series-shunt machine. The series arrangement and the shunt arrangement are combined with the compensating or self-regulating result to which I have already alluded.

The defenders' scientific witnesses all express in their examination in chief the opinion that Varley did not disclose or publish the series-shunt arrangement in the description which I have already quoted. They find Varley's description to be inconsistent with series-shunt, and suggestive of something quite different. The value of these opinions, however, is seriously diminished when consideration is given to the method by which they are reached. I think I do the defenders' witnesses no injustice when I say that their method is to take Varley's description, paragraph by paragraph, each by itself, and detached from the context, and then proceed to show how each separate paragraph is, when so read, inconsistent with, or suggestive of something other than series-shunt. As an example of this method of dealing with Varley's description, I may refer to the evidence of Prof. Silvanus Thompson, the first witness examined by the defenders. Such a method is neither reasonable nor fair. To do justice to Varley's description it must be read in its entirety; and when this is done even Mr. Thompson has to admit, as he does on cross-examination, that the description is "consistent with the series-shunt arrangement," which is just a somewhat guarded way of saying that it is descriptive of a series-shunt arrangement. In like manner (but with a greater degree of fairness) Sir William Thomson deals with the description. He finds that there are some things inconsistent with series shunt—that he "has been puzzled" in trying to understand the description which contains some words of a misleading rather than instructive tendency, and he concludes that an ordinary skilled workman would not in 1876, by Varley's description, "have had disclosed to him the system of series-shunt winding." That opinion certainly undergoes modification in the course of his examination, for he concludes his evidence in chief (on this part of the case) by saying that he thinks "it quite probable that in 1876 he (the ordinary skilled workman) might have been led to series-shunt by these descriptions." His cross-examination, however, brings him still nearer to the view which I have taken. He says: "The whole passage is consistent with series-shunt winding except the partial inconsistency of the first lines, which is not an absolute inconsistency." On the whole, I think Sir William Thomson may fairly be claimed by the pursuers as a witness in support of their views.

A great deal of evidence is adduced to show that Varley's description would not have enabled an ordinary skilled workman to construct a series-shunt machine, although some of the defenders' witnesses say that from Varley's description it would have been difficult only, not impossible. But assuming the fact to be that from Varley's description alone, the ordinary skilled workman could not have constructed a series-shunt machine, that is by no means conclusive of the question in the defenders' favour. A specification may so insufficiently describe the process or the machine patented as to render the patent invalid. It may, nevertheless, contain sufficient description to disclose or publish the invention, so as to prevent its being validly patented by another subsequently. But I think it has been demonstrated that Varley's description was sufficient to enable a workman to make his machine. The model, No. 37, which everyone admits to be a model of a series-shunt wound machine was made by a lad 19 years of age, apprenticed to an instrument maker, "from the information derived from Varley's patent with its drawings, and from nothing else. "It is entirely my own idea of Varley's patent." The same thing was done by others. On the other hand, while there are witnesses brought to say that the description is misleading and inconsistent, no skilled workman has been brought to prove that having tried to make the machine from Varley's description, he had been unable to do so.

It is further urged by the defenders that Varley had not when he invented his machine any knowledge of the value of series-shunt, and particularly of the quality of "constant potential," which by a series-shunt machine alone of the three I have mentioned can be approximately obtained; that series-shunt was not in his mind, but some method of series winding with a separate coil for separate excitation; that, on the other hand Brush knew the value of, and was seeking to find a self-regulating machine. These matters have not in my mind any very direct bearing on the question at issue, but they require to be noticed. In the first place, Varley deposes that in making his specification he "understood the electrical significance of series shunt winding," and I believe him. It is only due to Mr. Varley that I should say that whatever may be the soundness, or otherwise, of his electrical theories, there is no doubt in my mind of his honesty. When he speaks to facts, I think he may be entirely relied on. In the second place, whatever value Varley placed on the compound-winding of his machine, it was not in his view to make a machine which should proceed on the principle of separate excitation within the machine itself. He made a drawing (No. 40 of process) in November, 1878 (before the date of his provisional specification), which shows that he intended his machine to be a series-shunt, and not a series with separate excitation. With regard to that drawing, Prof. Silvanus Thompson says: "so far as that drawing goes it indicates a series-shunt arrangement." In the third place, without expressing any opinion as to what may have been the state of knowledge of either Varley or Brush before 1876 or 1878, as to the value or obtainability of "constant potential," it is certain that neither of them in their respective specifications say anything to indicate their appreciation of the value of that quality, or disclosed any view whatever as to the mode in which it was to be obtained. Even in 1878 constant potential was not felt to be a desideratum in electric machines; and, in regard to this matter, Varley and Brush for all that appears stand on an equal footing.

Lastly, on this branch of the case I have to notice that the defenders rely very much upon the fact that Varley in his specification did not claim the invention of compound winding. But Varley explains why he did not do so, and I have no doubt his explanation is true. Perhaps he was too timid; perhaps he had given a construction and attributed a value to his brother's communication which it would not bear and did not merit. And yet it appears that another skilled electrician at first reading took the same view of that communication which Varley did. But the fact that Varley did not claim a certain invention is no proof that he did not publish it.

I come now to the question whether the defenders' machine was anticipated by user.

A machine was constructed under Varley's specification in 1876 or 1877, which is produced. I think it is proved to be a series shunt machine. It has the two coils of wire round the magnets, one of greater resistance than the other, and was capable, undoubtedly, of being worked as a series-shunt, having an appropriate commutator for that purpose. But some of the defenders' witnesses say it was a merely experimental machine, and could be connected in a variety of ways. It was certainly not worked as a series machine with separate excitation, for the commutator used was quite inappropriate to, and negatived the idea of such use. How was it connected? Varley says: "The machine No. 29 was connected exactly in the way that is represented by that diagram" (No. 40). Sir William Thomson says that that diagram represents series-shunt. He is asked: "If you were told as a fact that this machine had been connected in accordance with the device shown in that sketch, would that convey to your mind a certainty that this machine had been worked as a series-shunt machine?" And he answers, "Yes." There are other signs spoken to, which, in the opinion of some of the witnesses, indicate that the machine was worked as a series-shunt; but there are contrary opinions also. I rely upon the evidence of Varley that his machine, which was undoubtedly capable of being connected and worked as a series-shunt, was so connected and worked. He knew best how his machine was connected, and as I have said, on any matter of fact, I have no doubt of Varley's accuracy and truthfulness. Then if it was so worked it was worked publicly. It was used publicly to illustrate certain operations in a diving tank, and for the purpose of photographing an ice machine. These were not experiments on the machine itself. They were the application of the machine to business purposes made in the presence of the public without secrecy or concealment. Very little use of a machine in such circumstances will constitute prior use. "If it is proved distinctly," said Lord Lyndhurst, "that a machine of the same kind was in existence, and was in public use, that is, if use or if trials had been made of it in the eye and in the presence of the public, it is not necessary that it should come down to the time when the patent was granted. If it was discontinued still that is sufficient evidence of the prior use so as to invalidate the letters patent." Such use of Varley's machine is, I think, distinctly proved.

I am therefore of opinion that the defenders' machine was anticipated by Varley's, both by publication and user, and that the defenders' patent is therefore invalid.

Lord TRAYNER accordingly gave decree of reduction as sought by the pursuers, with expenses.

PROCEEDINGS OF SOCIETIES.

Physical Society, June 22nd, 1889.

Prof. REINOLD, F.R.S., President, in the chair.

Major P. Cardew, R.E., and Mr. A. W. Ward, M.A., were elected members.

The following communications were made:—"Note on some Photographs of Lightning and of Black Electric Sparks," by Mr. A. W. CLAYDEN. The lightning photographs, three in number, were obtained during the storm on the 6th inst. Two flashes seen on one plate show a complicated and beautiful structure. One of them is a multiple flash, and flame-like appendages point upwards from every angle. The other is a broad ribbon, and although the plate shows signs of movement, the displacement is not in a direction such as would produce a ribbon-like effect from a simple flash. The second plate shows four flashes, none of which are ribbon-like, though the camera had moved considerably. The third plate was exposed to six flashes, one of which was believed to pass down the middle of the plate, but on development only a triple flash in one corner of the plate was seen. Careful search, however, revealed the central flash as a dark one with a white core, and other dark flashes were subsequently found. The plate was very much over-exposed, and this suggested that black flashes might be due to a sort of cumulative action caused by the super-

position of the glare from a white cloud upon the normal image of the flash. To test this, sparks from a Wimshurst machine were photographed, and before development the plates were exposed to diffused gaslight for a short time. The bright sparks yielded normal images with reversed margins, and the faint ones were completely reversed. Other experiments showed the reversal to spread inwards as the time of exposure to gaslight increased. Finally, reversal was effected by placing a white screen behind the spark to represent a white cloud, the only illumination being that of the spark itself.

In the discussion which followed, Mr. W. N. SHAW exhibited a photograph taken during the same storm, which is particularly rich in dark flashes branching outwards from an intensely bright one. In some places the bright line has dark edges, and in one part a thin bright line runs along the middle of an otherwise dark portion of the flash. In answer to Mr. Inwards, Mr. Shaw said the plate was exposed about half a minute, and the former thought that under those conditions the appearance of the plate did not contradict Mr. Clayden's hypothesis.

Speaking of the same photograph, Prof. PERRY considered that Mr. Clayden's observations would explain the result, for a bright flash required more exposure to diffused light to reverse it than a faint one did.

Prof. RAMSAY reminded the meeting that Prof. Stokes's "oxides of nitrogen" explanation was still a possible one, and Mr. C. V. BURTON asked whether they may be due to faint sparks cutting off light from brightly illuminated clouds, just as a gas flame absorbs light from a brighter source.

In reply, Mr. CLAYDEN thought the "oxides of nitrogen" hypothesis improbable, and said his experiments did not enable him to answer Mr. Burton's question. As regards Mr. Shaw's plate, he believed the diffused light from the clouds would be sufficient to reverse the fainter tributary flashes, although it was insufficient to reverse the primary one. From data obtained when the ribbon flash was taken, he had made some calculations which gave the height of the clouds about 1,000 yards, and the ribbon flash 1,300 yards long and 100 yards wide.

"Researches on the Electrical Resistance of Bismuth," by Dr. ED. VON AUBEL. The paper, which is in French, was taken as read. A translation will appear in the Proceedings of the Society.

"Expansion with Rise of Temperature of Wires under Pulling Stress," by J. T. BOTTOMLEY, M.A., F.R.S. The investigation was to determine whether the coefficient of expansion of wires depends on the stress to which they are subjected, and was undertaken in connection with the secular experiments on the elasticity and ductility of wires now being conducted at Glasgow University.

Two wires, about 17 feet long, of the same material were suspended side by side within a tube through which steam could be passed to change the temperature. One wire was loaded to half and the other to one-tenth its breaking weight, and in the preliminary experiments the elongations were read by a Quincké microscope cathetometer. About 150 heatings and coolings, extending over three months, were necessary to bring the heavily-loaded wire to its permanent state, so that consecutive expansions and contractions were equal. When this stage was arrived at, hooks of peculiar shape were attached to the lower ends of the wire. These hooks form a relative geometrical guide, and their horizontal parts mutually support a small table which carries a plane mirror. If the wires expand or contract unequally, the mirror becomes tilted, and the relative displacement is observed by means of a telescope and scale fixed nearly vertically over the mirror.

From experiments on copper wires, the coefficient of relative expansion was found to be $0{\cdot}32 \times 10^{-6}$ per degree centigrade, or about $\frac{1}{3\frac{1}{2}}$th of the ordinary linear expansion of the material. The heavily-loaded wire expanded most. The results for platinoid give $0{\cdot}27 \times 10^{-6}$ as the relative coefficient under the conditions named above; this is about $\frac{1}{4\frac{1}{2}}$th of the ordinary linear expansion, which from separate experiments was found to be $15{\cdot}4 \times 10^{-6}$.

Mr. H. TOMLINSON thought the probationary period for copper might be considerably shortened by repeatedly putting on and taking off the load, and by subjecting the wire to torsional oscillation. With iron wires this would not be the case, for they behave in a most peculiar manner, and require long periods of rest after each oscillation. From experiments he had conducted during the last two years he found that the permeability of iron could be enormously reduced by repeated heatings and coolings whilst undergoing magnetic cycles of small range.

Mr. GREGORY said the paper threw considerable light on some experiments on the sag of stretched wires upon which he was engaged. He also suggested heating the wires by electric currents.

In reply, Mr. BOTTOMLEY said he had considered it important to leave the wires untouched after being suspended, and as regards heating by electricity, he thought that convection currents would make the temperature non-uniform.

Owing to the absence of Prof. S. P. Thompson, his "Notes on Geometrical Optics" were postponed.

NEW PATENTS—1889.

9885. "Improvements in or relating to electrical alarm clocks and indicators." G. SCARLETT. Dated June 17.

9917. "Improvements in switches used for electrical purposes." F. B. NICHOLSON. Dated June 17.

9945. "Improvements in arc lamps." L. HANSON. Dated June 17.

9977. "Improvements in electrical reciprocating tools." W. P. THOMPSON. (Communicated by H. N. Marvin, United States.) Dated June 17. (*Complete.*)

9988. "Improvements in electricity meters." J. S. RAWORTH Dated June 18.

9994. "Improvements in apparatus for the manufacture of sugar by electricity." E. MAIGROT and J. SABATES. Dated June 18. (*Complete.*)

9999. "Improvements in the manufacture of insulated electrical conductors and cables." E. T. TRUMAN. Dated June 18.

10082. "Improvements relating to electric switches, fuse blocks, ceiling plates, and the like." G. BINSWANGER. Dated June 20.

10102. "Improvements in subterranean conduits for electric wires, &c., which may also be employed for the purposes of pneumatic transmission." H. J. ALLISON. (Communicated by R. Macdonald, United States.) Dated June 20. (*Complete.*)

10143. "Improved means for operating electric light switches." A. L. VOGEL. Dated June 21.

10155. "Improvements in electric tramcars and locomotives." J. S. RAWORTH. Dated June 21.

10173. "Improvement in stop motion for looms by electricity." J. VICKERMAN. Dated June 22.

10209. "Improvements in electrical accumulators or storage batteries." J. ZACHARIAS and F. MARX. Dated June 22.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1888.

6893. "Improvements in electro-magnetic and magneto-electric generators." E. COX WALKER. Dated May 9. 8d. The inventor employs an armature and permanent or other magnets of ordinary or any suitable construction, but he dispenses with the toothed or frictional multiplying gear usually employed to transmit a rotary motion to the armature, and in lieu thereof he makes use of a rapid pitch screw, such as is employed in an ordinary Archimedian drill, which may engage in the hollow spindle of the armature, causing the latter to rotate rapidly when pushed in or pulled out. 4 claims.

6985. "Improved switch for electrical tramcars." M. IMMISCH. Dated May 10. 11d. Claim:—The improved switch for electromotors, consisting in a spindle mounted eccentrically to a disc and carrying an arm with a projection capable of engaging with projections on the disc, so that the latter is actuated thereby for only a portion of the travel of the switch arm, such arm serving to introduce resistances successively before the circuit is broken, and to take out such resistances after the circuit is again completed, the contacts for establishing and breaking the circuit being carried by the disc actuated by such arm, all substantially as and for the purposes specified.

7523. "Means and apparatus for electric lighting." E. J. HOUGHTON. Dated May 22. 8d. Claim:—Combining a dynamo with a lamp circuit and with accumulators in such manner that the accumulators are arranged in two portions, either in parallel or in partial parallel, and that a resistance is interposed between the dynamo and the lamp circuit, whereby, while the current from the dynamo is made to charge the two sets of accumulators alternately by a switch, a small portion only of such current passes through the resistance to the lamp circuit, together with the current from the charged set of accumulators, substantially as and for the purposes set forth.

8765. "Improvements in holders for incandescent electric lamps." W. ROWBOTHAM and W. FOX. Dated June 15. 8d. The inventors form the holders for capped lamps of a tube of sufficient internal diameter to admit the cap of the lamp, closed at the lower end with a disc of insulating material fitted to the inside of the tube after the manner of a piston, and pressed toward the mouth of the tube by a spiral spring fitting close in the tube, the spring bearing at one end against the base of the tube, and at the other end against the bottom face of the insulating disc. The insulating disc is pierced in the centre to allow the leading wires to pass through, and carries two screw studs to receive the ends of the wires, said studs being in such a position as to bear against the plates on the base of the lamp when the lamp is in the holder. In each of the opposite sides of the tube is cut a straight slot, extending from a short distance from the top to near the bottom, and a second slot is cut in an oblique direction from the top to meet the first slot a little distance from its end, so that on the trunnion pins on the lamp caps being passed into the second slot and the lamp pressed downward, the slot causes the lamp to make a slight movement sideways; and on the pressure being removed the trunnion pins fall into the ends of the first slots, locking the lamp in position. A guide pin is inserted into each side of the insulating disc, projecting into the first slots, to prevent rotation of the insulating disc. 3 claims.

8809. "Improvements in electric switches." H. H. LAKE. (Communicated from abroad by S. Bergmann, of America.) Dated June 15. 8d. Consists in a novel switch for electrical purposes,

in which is employed a rotary part, or wheel made of incombustible material, such, for instance, as porcelain. This rotary part or wheel is provided with alternate metallic and non-metallic surfaces. The improvement also consists in the combination with a switch wheel of a base piece of insulating material, an upright shell secured to the base piece, a rotary part or wheel of incombustible material mounted upon said shell, a shaft supported by the shell, and a connection between the shaft and the switch wheel. The claims are 10 in number.

8905. "Improvements in electric batteries." H. LAHOUSSE & Co. and C. COLLE. Dated June 18. 8d. Claims:—1. A two liquid battery wherein a solution of bisulphate of mercury and concentrated nitric acid in suitable proportion in water, as set forth, is employed to act on a zinc in a porous vessel, and in which granular retort carbon is employed in combination with the ordinary carbons, being immersed in nitric acid with the object of increasing the acting surface, and at the same time facilitating the employment of a pitch or other like seal, substantially as described and illustrated in the drawings. 2. The combinations and arrangements of parts and materials constituting the improvements in electric batteries as described.

9046. "Improvements in magneto-electric bells." E. COX-WALKER and A. A. CAMPBELL-SWINTON. Dated June 21st. 8d. The inventors employ a suitable horseshoe electro-magnet with an armature pivotted in front of its poles in such a manner that the said armature can vibrate in front of the said poles under the influence of the attraction of the same with facility, the said armature having attached to it a striker or hammer to strike the gong or gongs employed. 4 claims.

9405. "A method and apparatus for transforming alternating into continuous currents of electricity for charging electrical accumulators." R. F. YORKE. Dated June 28. 6d. An electrical motor capable of being worked by alternating currents of electricity is fixed so as to drive an ordinary continuous current dynamo. When the alternating motor is working a continuous current will then be produced by the dynamo, and this current may be employed either for charging accumulators alone or for charging accumulators and lighting electric lamps at the same time. 2 claims.

9487. "Improvements in electrical instruments operated by electro-magnetic attraction." F. L. RAWSON and W. WHITE. Dated June 29. 8d. The inventors wind a coil of wire upon a tube and mount this between pivots whose axis is at about the middle of the coil and in a direction at right angles to the magnetic axis of the coil, so that the whole coil is free to rotate on the pivots in a plane parallel to its magnetic axis. The free ends of the coil or connection pieces attached to them are carried out at one end of the coil and arranged to dip into two mercury cups forming the terminals of the instrument, and thus the coil is included in and completes the electrical circuit in which the instrument is placed. A movable core formed of a soft iron ball is placed inside the tube; when the instrument is in its working position with the coil ends in the mercury cups, this iron ball rests against a soft iron screw placed at the end of the tube next the mercury cups, and to keep it normally in this position, the axis of the coil and tube is inclined downwards somewhat towards this end. When the current passing through the coil exceeds a determined amount, the iron ball is drawn up into the coil by the attraction exerted upon it by the current in the coil, which overcomes the effect of gravity and the magnetic attraction of the iron stop screw; the lower end of the tube and coil is thus relieved of the weight of the iron ball, and the system being suitably balanced, this end rises, lifting the coil and connections out of the mercury cups, and so breaking the circuit. The coil system turns sufficiently on its pivots as the circuit is broken to leave the axis of the tube inclined in the opposite direction to what it was before, so that there is no tendency for the iron core to return to its former position. 4 claims.

9825. "Improvements relating to switches for electrical purposes." W. MACKIE. Dated July 6. 8d. Claim:—A loose driving crank, having "back lash" or lost time between the driving pin of the handle and the crank pin itself, and making the crank pin pull or push on or off the connecting pieces of an electric switch in connection with a spring, substantially as described.

9854. "Improvements in and connected with secondary batteries or electrical accumulators." L. BRISTOL. Dated July 6. 8d. The inventor intimately mixes and incorporates with the red lead or equivalent active material employed to form the plates a suitable proportion of animal hair, preferably human, or feathers or parts of feathers, or thin shearings or shavings of horn, or vulcanised fibre, or asbestos fibre, or any other suitable fibrous substance cut to proper and suitable dimensions. 4 claims.

9907. "An improvement in electric current and tension meters." M. VON DOLIVO-DOBROWOLSKY, and the Company "ALLGEMEINE ELECTRICITATSGESELLSCHAFT," both of Berlin. Dated July 7. 8d. Relates to electric current and tension meters, and the improvement consists in the combination, with a solenoid, of an axle being vertical to or forming an angle with the axis of the solenoid and carrying one or more bunches or pencils of thin wires of soft iron and a pointer, the said axle having connected to it a weight or a spring, which normally maintains the axle in such position that a current passing through the solenoid and magnetising the wires of the bunch or bunches will cause the axle to turn, while with the increase of its angle of rotation the resistance presented by the said weight or spring increases, either in the same or in different ratio. The quantity or tension of the current thus measured by the latter is indicated by the pointer on a graduated arc. 1 claim.

10107. "Improvements in casing used for electrical conductors." C. S. SNELL. Dated July 11. 8d. The inventor forms the casing of paper or its equivalent composition such as millboard, strawboard, pasteboard or papier-maché and moulds, sets, rolls or otherwise forms it into convenient shape for one or more electrical conductors. This paper, or its equivalent, he treats either in the pulp stage or after its final shape has been given with waterproofing or fireproofing solutions or both, or he may intermix with or form the pulp partially from asbestos with alum and borax, this paper being very incombustible. The waterproofing solution may consist of a solution of oxide of copper in ammonia which partially dissolves the cellulose of the paper and converts it into an impermeable varnish or simple coating with soap and then with sulphate of copper or alum or any other well known composition or medium may be used. The claims are 5 in number.

17267. "Improvements relating to electric apparatus for propelling tramway cars and other vehicles, and to means for transmitting electric currents to such apparatus." H. H. LAKE. (Communicated from abroad by J. Klames, of America.) Dated November 27. 8d. Relates to electrical mechanism for propelling street cars and other conveyances, and the object thereof is to provide simple means whereby contact may be preserved between the main conductor or cable and the arm or arms taking the current therefrom to the motor. Another object of the said invention is to provide means whereby the rocking movement of the car, as well as the rise and fall of the frame by variations in the weight carried, may be automatically compensated. A further object of the invention is to provide a simple insulating bearing for the contact arms, which shall avoid the necessity of lubrication and give complete insulation. A still further object of the said invention is to provide a conduit for the purpose of transmitting electrical energy to a motor by which a public conveyance is propelled. The claims are 9 in number.

CORRESPONDENCE.

A Severe Test.

My attention has been called to a short editorial in your issue of May 24th, 1889, giving an account of how I had succeeded in forestalling Mr. Sprague in treating the armature of a motor to a 24-hour salt water bath, taking it out and then running it on an overload, without first drying it.

The facts as to the *experiment* are correct, but the *parties* thereto are rather mixed. I am an officer of the Sprague Company, and it was only as such that I described in the *Electrical World*, May 11th, the experiments which Mr. Sprague directed and at which I assisted. I merely write this that you may know that it was Mr. Sprague, after all, who carried out his own promise.

S. D. Greene,
Chief Engineer, Sprague Electric Railway and Motor Company.

New York, *June 18th*, 1889.

Spinning Crystal.

As quartz threads are likely to play a considerable part in the future of our galvanometers, &c., it may possibly be of interest to the readers of your interesting journal that a full account of spinning crystal may be found in the *Magazine of Science* for April, 1842, p. 39. The article is an account of the experiments of M. Gaudin; a few extracts from the letter are as follows:—"M. Gaudin has succeded in drawing out crystal into threads, several feet in length, with the greatest ease." "It resembles steel in elasticity and tenacity." "Siliceous compounds act nearly in the same way as rock crystals." "The emerald threads well, and its threads, which scratch rock crystal, are more tenacious than crystal threads." He uses the oxyhydrogen blowpipe for welding the crystal; he found that threads of quartz appeared irridescent and floated on the air. "Threads of pure quartz were always cylindrical and transparent;" "he also drew out quartz into sticks for burnishers."

F. M.

Abingdon.